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MARKET ANALYSIS AND CONSUMER IMPACTS SOURCE DOCUMENT

Part II Review of Motor Vehicle Market and Consumer Expenditures on Motor Vehicle Transportation

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U.S. DEPARTMENT OF TRANSPORTATION
Research and Special Programs Administration
Transportation Systems Center
Cambridge MA 02142

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FINAL REPORT

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U.S. DEPARTMENT OF TRANSPORTATION
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16. Abstract

This source document on motor vehicle market analysis and consumer impacts consists of three parts. Part I is an integrated overview of the motor vehicle market in the late 1970's, with sections on the structure of the market, motor vehicle trends, consumer trends, and market outlook. Part II consists of studies and review on: motor vehicle sales trends; motor vehicle fleet life and fleet composition; car buying patterns of the business market; impact of downsizing on automotive preference of new car buyers; demand for light trucks, recreational vehicles, used cars, and station wagons; and consumer expenditures for private motor vehicle transportation. Part III consists of studies and reviews on: consumer awareness of fuel efficiency issues; consumer acceptance of fuel efficient vehicles; car size choices; passenger car choices; truck choices; and motor vehicle usage trends.

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PREFACE

This report, DOT-TSC-NHTSA-80-2.II "Market Analysis and Consumer Impacts Source Document," summarizes the studies and reviews on the motor vehicle market of the 1970's which TSC has performed during the past two years as part of its support to the NHTSA Automotive Fuel Economy Program.

The source document is presented in three parts. Part I is an integrated overview of the motor vehicle market in the late 1970's. Part II is a series of reviews of the motor vehicle market and consumer expenditures on motor vehicle transportation. Part III is a review of behavioral and attitudinal studies on the consumers of motor vehicle transportation.

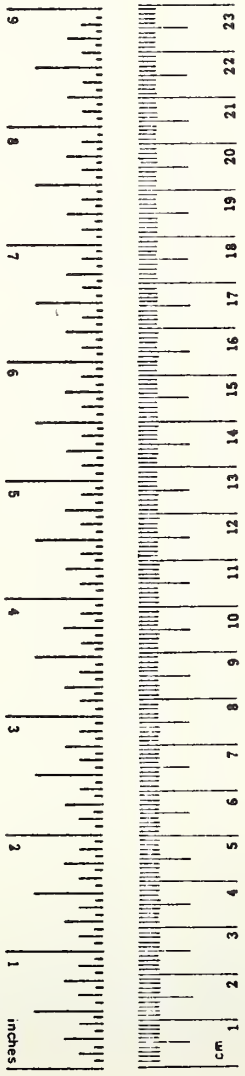
This document is deliverable under PPA HS-163, "Support for Research and Analysis in Auto Fuel Economy and Related Areas."

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

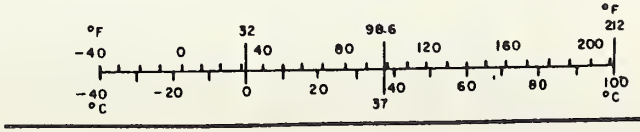
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	squere meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	squsre kilometers	km^2
	acres	0.4	hectares	he
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	taespoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	millilitars	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fehrenheit tempersture	5/9 (after subtrecting 32)	Celsius temperatura	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures. Price $2.25. SD Catalog No. C13.10.286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hecteres (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Calsius tempersture	9/5 (then add 32)	Fshrenheit temperature	°F



MARKET ANALYSIS AND CONSUMER IMPACTS
SOURCE DOCUMENT

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I. MOTOR VEHICLE SALES AND MARKET TRENDS*

1.1 INTRODUCTION

The federally mandated emission control standards, fuel economy standards, and safety standards, along with the Arab oil embargo in 1973 and 1974 and the economic recession of the mid-1970's, have brought about changes in the sizes and types of motor vehicles purchased from 1971 to 1978. This section discusses the trends in motor vehicle sales and market shares which have occurred during this time period in response to these regulations and economic conditions.

1.2 MAJOR FINDINGS

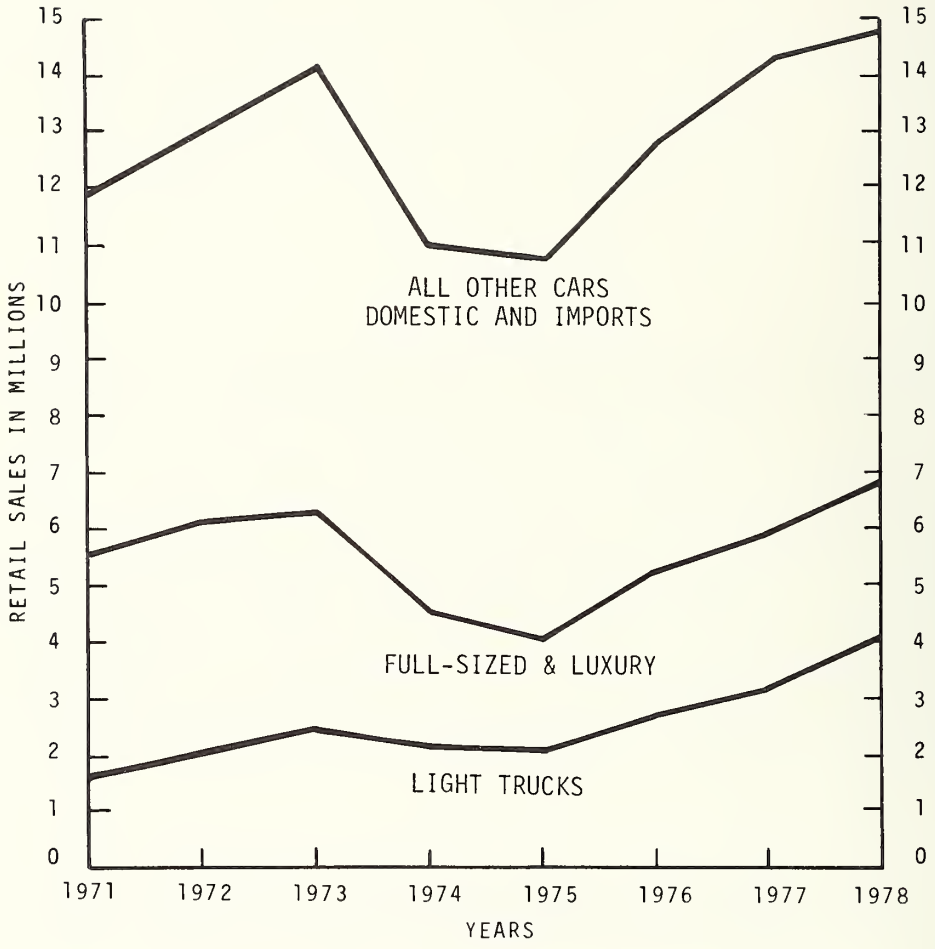
- The general sales trend during the 1970's has been toward the smaller, more fuel efficient cars and light trucks.
- The average annual motor vehicle sales growth rate was approximately 3.1 percent from 1971 to 1978.
- Between 1971 and 1978, the market share of full-sized cars was halved. The increase in light truck sales represented two-thirds of this share loss, and the increase in small domestic and imported cars represented one-third of this share loss.

1.3 SALES

Motor vehicle sales, which rose from 11.9 million vehicles in 1971 to 14.1 million vehicles in 1973, fell to 10.8 million vehicles during the recession year 1975. Since that time, however, sales rose steadily to almost 15 million vehicles in 1978. (See Figure 1-1, Tables 1-1 and 1-2.) The annual growth rate from 1971 to 1978 was approximately 3.1 percent.

The general sales trend during the 1970's has been toward the smaller cars and light trucks. This trend, which began in the late

*This section covers motor vehicle sales and market trends between 1971 and 1978. The primary research for this section was performed in the spring of 1979.



Source: TSC Analysis of MVMA and Ward's Data.

FIGURE 1-1. MOTOR VEHICLE SALES, BY YEAR

TABLE 1-1. RETAIL SALES SUMMARY SHEET BY INDUSTRY CLASSIFICATION, BY YEAR

	1971	1972	1973	1974	1975	1976	1977	1978
Imports (Includes Captives)	1,563,178	1,613,706	1,748,061	1,399,081	1,571,472	1,498,753	2,074,390	1,999,915
Domestic Cars								
Subcompacts	759,553	893,522	1,072,440	1,082,091	1,086,018	999,565	952,905	1,210,165
Compact	1,585,992	1,603,134	1,990,079	1,782,508	1,844,604	2,316,798	2,226,497	2,223,101
Intermediate	2,393,145	2,726,499	2,851,217	2,162,093	2,058,059	2,706,213	2,959,646	3,007,772
Full Size	3,533,417	3,612,691	3,400,054	1,977,135	1,547,286	1,999,515	2,272,819	2,141,264
Luxury	374,590	411,117	449,949	352,723	409,067	468,161	559,638	581,547
Passenger Vans	62,148	74,519	86,703	92,189	105,086	119,519	137,517	147,817
Totals (Domestic)	8,708,845	9,321,482	9,850,442	7,448,739	7,050,120	8,609,771	9,109,022	9,311,666
Total Passenger Cars (Domestic and Imports)	10,272,023	10,935,188	11,598,503	8,847,820	8,621,592	10,108,524	11,183,412	11,311,581
Light Trucks								
0-6000 lbs								
Utility				157,014	65,156	60,968	68,674	79,588
Car Type Pickup				75,288	53,534	66,667	76,997	83,522
Compact Imported Pickup				175,497	228,097	236,211	321,364	334,918
Van & Cutaway Chassis				205,429	178,943	185,340	117,354	126,072
Conventional Pickup				893,452	693,588	904,287	909,016	904,002
Station Wagon (Truck Chassis)				48,913	4,454	438	23	-
Passenger Carriers				2,263	371	582	429	472
Multistop				2,229	93	5	-	-
Other				7,179	2,950	8	4	-
Total 0-6000 Lbs	1,184,741	1,497,630	1,754,254	1,567,264	1,227,186	1,454,506	1,493,861	1,528,574
6001-10,000 Lbs								
Utility				2,668	92,825	152,366	183,345	275,790
Vans				} 117,133	} 199,416	} 337,475	380,641	471,334
Van Cutaway							77,978	76,277
Conventional Pickup				469,195	540,580	799,564	1,032,190	1,171,257
Station Wagon (Truck Chassis)				15,487	50,128	72,832	87,764	100,395
Passenger Carriers				1,243	3,228	4,746	5,632	6,398
Multistop				27,581	25,469	33,517	35,142	38,193
Other				62,941	40,064	447	-	-
Total 6001-10,000 Lbs	487,633	598,813	758,236	696,248	951,710	1,400,947	1,802,692	2,139,644
Total Light Trucks	1,672,374	2,096,443	2,512,490	2,263,512	2,178,896	2,855,462	3,296,553	3,668,218
Total Motor Vehicles	11,944,397	13,031,631	14,110,993	11,111,332	10,800,488	12,963,977	14,479,965	14,979,799

Source: References 1, 2, 3, 4.

TABLE 1-2. U.S. DOMESTIC RETAIL PASSENGER CAR SALES BY MANUFACTURER, BY CLASS, BY YEAR (1971-1978)

	1971	1972	1973	1974	1975	1976	1977	1978
AMC								
SUBCOMPACT	73,636	104,315	133,146	104,871	66,614	50,805	38,071	25,693
COMPACT	95,791	118,463	166,328	136,074	194,610	161,776	123,965	135,575
INTERMEDIATE	46,905	48,443	55,960	77,720	61,048	35,059	22,325	9,471
FULL-SIZED	40,631	41,050	40,397	16,428	-	-	-	-
LUXURY	-	-	-	-	-	-	-	-
PASSENGER VANS	-	-	-	-	-	-	-	-
TOTALS	256,963	312,271	395,831	335,093	322,272	247,640	184,361	170,739
CHRYSLER								
SUBCOMPACT	-	-	-	-	-	-	-	208,490
COMPACT	540,779	579,999	640,413	605,378	405,503	679,871	550,557	367,433
INTERMEDIATE	555,097	574,629	519,211	268,851	354,691	378,786	441,752	437,954
FULL-SIZED	270,212	313,253	490,259	265,400	179,683	190,241	168,296	74,110
LUXURY	12,982	15,033	13,019	12,205	4,909	-	-	-
PASSENGER VANS	24,488	34,696	46,391	51,800	52,330	56,240	59,147	58,271
TOTALS	1,403,558	1,517,610	1,709,293	1,203,634	997,116	1,305,138	1,219,752	1,146,258
FORD								
SUBCOMPACT	340,756	456,561	479,668	635,713	521,637	433,102	426,915	415,876
COMPACT	449,243	427,384	524,659	377,516	589,302	655,652	672,082	824,411
INTERMEDIATE	464,542	646,169	622,140	543,183	344,283	430,768	712,061	638,315
FULL-SIZED	992,052	957,003	831,472	503,156	366,872	481,152	521,109	469,649
LUXURY	68,376	100,305	118,036	87,104	96,502	122,003	181,282	188,487
PASSENGER VANS	20,587	21,641	21,288	20,340	28,324	32,942	38,761	45,964
TOTALS	2,335,556	2,609,063	2,597,263	2,167,012	1,946,920	2,155,619	2,552,210	2,582,702

TABLE 1-2. U.S. DOMESTIC RETAIL PASSENGER CAR SALES BY MANUFACTURER, BY CLASS, BY YEARS (1971-1978) (CONTINUED)

	1971	1972	1973	1974	1975	1976	1977	1978
GM								
SUBCOMPACT	345,161	332,646	459,626	341,587	497,767	515,658	487,919	537,524
COMPACT	500,179	477,288	658,679	663,540	655,189	819,499	879,893	895,682
INTERMEDIATE	1,326,601	1,457,258	1,653,906	1,272,339	1,298,037	1,861,600	1,783,508	1,922,032
FULL-SIZE	2,230,522	2,301,385	2,037,926	1,192,151	1,000,731	1,328,122	1,578,846	1,593,402
LUXURY	293,232	295,779	318,894	253,414	307,656	346,158	378,356	393,060
PASSENGER VANS	17,073	18,182	19,024	20,049	24,432	30,337	39,609	43,582
TOTAL	4,712,768	4,882,538	5,148,055	3,743,000	3,783,812	4,901,374	5,148,131	5,385,282
VW								
SUBCOMPACT	-	-	-	-	-	-	-	22,582
TOTAL					-			
CHECKER								
FULL-SIZE	-	-	-	-	-	-	4,568	4,103
TOTALS	8,708,845	9,321,482	9,850,442	7,448,739	7,050,120	8,609,771	9,109,022	9,311,666

1960's, antedates the "Energy Crisis" and economic recession of the mid-1970's. The Arab oil embargo in late 1973 and early 1974, along with the recession of 1975 and the enactment of the Energy Policy and Conservation Act in late 1975, served to accelerate the sales losses in the full-sized cars. The small domestic and imported car market gained one-third of the full-sized car market share losses, while the light truck market gained two-thirds of the full-sized car market share losses. Some consumers apparently selected a light truck as an alternative to a car equipped with a catalyst, a device which was introduced in 1975 in response to EPA's automobile emissions standards. Annual retail sales of the full-sized car fell 1.4 million vehicles between 1971 and 1978, with the greatest decline of 1.8 million vehicles occurring at the height of the energy crisis and recession from 1973 to 1975. Since 1976, full-sized car sales have grown by 141,000 vehicles. (See Table 1-3).

The retail sales losses of the full-sized car were reflected in the subcompact car sales gain (see Table 1-4) during the 1971 to 1978 time period. Annual subcompact car sales rose 326,000 vehicles between 1971 and 1975. A slight decrease in annual sales of 47,000 vehicles occurred between 1976 and 1977. However, subcompact car sales were on the increase (up 257,000 vehicles) between 1977 and 1978.

The compact car market also benefited from the sales losses of the full-sized car. Annual compact car sales growth (see Table 1-5) increased steadily from 1971 through 1976. Sales during this time increased 731,000 vehicles. From 1977 to 1978, a very slight loss in sales (3,400 vehicles) occurred.

Annual sales of the intermediate sized car (see Table 1-6), which grew steadily from 1971 through 1973 (458,000 vehicles), fell 793,000 vehicles between 1973 and 1975. The intermediates began to recover sales in 1976, and the 1978 sales were nearly 50 percent (950,000) higher than in 1975.

TABLE 1-3. FULL-SIZED RETAIL CAR SALES, BY YEAR

	STANDARDS - FULL SIZE	1971	1972	1973	1974	1975	1976	1977	1978
AM	Ambassador	40,631	41,050	40,397	16,428	-	-	-	-
	AM SUBTOTAL	40,631	41,050	40,397	16,428	-	-	-	-
C	Chrysler	160,965	186,061	162,977	95,364	75,209	102,353	104,356	67,892
C	Dodge/Royal Monaco	109,247	127,192	111,776	63,483	41,565	38,937	32,248	2,178
C	Plymouth Gran Fury	-	-	215,486	106,553	62,909	48,951	31,692	980
C	St. Regis	-	-	-	-	-	-	-	3,060
	CHRYSLER SUBTOTAL	270,212	313,253	490,259	265,400	179,683	190,241	168,296	74,110
F	Ford-LTD	836,416	791,042	685,064	418,819	295,332	376,003	380,499	332,930
F	Mercury	155,636	165,961	146,408	84,337	71,540	105,149	140,610	136,719
	FORD SUBTOTAL	992,052	957,003	831,472	503,156	366,872	481,152	521,109	469,649
GM	Buick	422,522	412,752	370,822	203,619	209,487	282,492	323,860	312,119
GM	Chevrolet	988,938	1,010,749	862,004	565,376	400,087	470,208	657,151	621,140
GM	Oldsmobile	349,724	373,656	340,752	178,927	204,003	278,004	349,403	396,815
GM	Pontiac	346,061	359,700	316,778	154,780	115,217	151,001	198,763	209,536
GM	Riviera	39,403	35,674	27,403	18,083	14,878	21,570	20,809	25,753
GM	Thunderbird	41,801	58,731	74,759	47,646	36,803	100,658	-	-
GM	Toronado	42,073	50,123	45,408	23,720	20,256	24,189	28,860	28,039
	GM SUBTOTAL	2,230,522	2,301,385	2,027,926	1,192,151	1,000,731	1,328,122	1,578,846	1,593,402
CH	Checker	-	-	-	-	-	-	4,568	4,103
	CHECKER SUBTOTAL	-	-	-	-	-	-	4,568	4,103
	TOTALS	3,533,417	3,612,691	3,400,054	1,977,135	1,547,286	1,999,515	2,272,819	2,141,264

NOTE: '77 T'Bird is intermediate

Source: References 1, 2, 5.

TABLE 1-4. SUBCOMPACT RETAIL CAR SALES, BY YEAR

SUBCOMPACTS	1971	1972	1973	1974	1975	1976	1977	1978
AM Gremlin	73,636	104,315	133,146	104,871	66,614	50,805	38,071	25,693
AM SUBTOTAL	73,636	104,315	133,146	104,871	66,614	50,805	38,071	25,693
C Horizon	-	-	-	-	-	-	-	118,993
C Omni	-	-	-	-	-	-	-	89,497
CHRYSLER SUBTOTAL	-	-	-	-	-	-	-	208,490
F Bobcat	-	-	-	-	37,605	36,365	35,481	30,201
F Capri	-	-	-	-	-	-	-	18,035
F Mustang II	-	-	-	277,846	201,370	167,201	170,659	199,760
F Pinto	340,756	456,561	479,668	357,867	282,662	229,536	220,775	67,880
FORD SUBTOTAL	340,756	456,561	479,668	635,713	521,637	433,102	426,915	415,876
GM Astre	-	-	-	5,662	53,792	41,148	28,693	1,299
GM Chevette	-	-	-	-	42,204	140,974	196,218	247,088
GM Monza	-	-	-	4,973	120,567	91,586	83,413	158,127
GM Skyhawk	-	-	-	3,864	30,243	31,128	24,872	22,221
GM Starfire	-	-	-	3,507	29,354	27,501	19,120	18,351
GM Sunbird	-	-	-	-	4,605	50,070	61,790	90,438
GM Vega	345,161	332,646	459,626	323,501	217,002	133,251	73,813	-
GM SUBTOTAL	345,161	332,646	459,626	341,507	497,767	515,658	487,919	537,524
VW Rabbit	-	-	-	-	-	-	-	22,582
VW SUBTOTAL	-	-	-	-	-	-	-	22,582
TOTALS	759,553	893,522	1,072,440	1,082,091	1,086,018	999,565	952,905	1,210,165

Source: References 1, 2, 5.

TABLE 1-5. COMPACT RETAIL CAR SALES, BY YEAR

	COMPACTS	1971	1972	1973	1974	1975	1976	1977	1978
AM	Hornet/Concord	71,452	92,506	140,017	118,519	97,841	81,884	78,332	114,764
AM	Javelin/AMX	24,339	25,957	26,311	17,555	-	-	407	-
AM	Pacer	-	-	-	-	96,769	79,892	45,226	20,811
	AM SUBTOTAL	95,791	118,463	166,328	136,074	194,610	161,776	123,965	135,575
C	Aspen	-	-	-	-	4,808	-	242,111	157,308
C	Barracuda	10,621	17,763	17,781	6,116	-	-	-	-
C	Challenger	30,441	25,983	24,410	9,532	-	232,742	-	-
C	Dart	242,787	231,180	250,619	238,264	166,094	60,946	1,898	-
C	Valiant	256,930	305,073	347,603	351,466	228,083	74,924	2,243	-
C	Volare	-	-	-	-	6,518	311,259	304,305	210,125
	CHRYSLER SUBTOTAL	540,779	579,999	640,413	605,378	405,503	679,871	550,557	367,433
F	Comet/Zephyr	65,391	68,718	80,370	82,919	43,570	27,265	42,234	120,781
F	Granada	-	-	-	55,597	306,517	387,423	355,186	219,026
F	Maverick/ Fairmont	256,790	238,077	288,983	218,516	145,133	118,907	167,841	405,780
F	Monarch	-	-	-	20,484	94,082	122,057	106,821	78,824
F	Mustang	127,062	120,589	155,306	-	-	-	-	-
	FORD SUBTOTAL	449,243	427,384	524,659	377,516	589,302	655,652	672,082	824,411
GM	Apollo/Skylark	-	-	38,709	49,135	68,025	108,206	97,196	97,915
GM	Camaro	128,106	45,330	108,381	136,404	145,029	172,846	208,511	260,201
GM	Firebird	55,462	22,865	52,214	67,391	82,652	108,348	137,807	188,212
GM	Nova	265,170	325,420	334,371	308,230	267,946	312,379	312,135	248,214
GM	Omega	-	12,675	50,679	42,436	39,157	56,324	51,724	42,860
GM	Ventura Phoenix	51,441	70,998	74,325	59,944	52,380	61,396	72,520	58,280
	GM SUBTOTAL	500,179	477,288	658,679	663,540	655,189	819,499	879,893	895,682
	TOTALS	1,585,992	1,603,134	1,990,079	1,782,508	1,844,604	2,316,798	2,226,497	2,223,101

Source: References 1, 2, 5.

TABLE 1-6. INTERMEDIATE RETAIL CAR SALES, BY YEAR

	INTERMEDIATES	1971	1972	1973	1974	1975	1976	1977	1978
AM	Matador	46,905	48,443	55,960	77,720	61,048	35,059	22,325	9,471
	AM SUBTOTAL	46,905	48,443	55,960	77,720	61,048	35,059	22,325	9,471
C	Belvedere/Satellite	140,624	154,528	180,753	-	-	-	-	-
C	Charger SE	-	-	-	7,763	33,701	34,091	29,099	*
C	Cordoba	-	-	-	15,001	148,943	175,456	142,619	105,442
C	Coronet/Charger/Monaco	154,250	164,341	157,705	112,506	67,937	67,176	59,559	37,594
C	Diplomat	-	-	-	-	-	-	40,072	60,656
C	Fury	260,223	255,760	180,753	133,581	104,110	97,063	92,056	60,378
C	LeBaron	-	-	-	-	-	-	70,037	125,558
C	Magnum XE	-	-	-	-	-	-	8,310	*48,326
	CHRYSLER SUBTOTAL	555,097	574,629	519,211	268,851	354,691	378,786	441,752	437,954
F	Cougar XR7	51,533	50,119	58,424	72,857	51,673	127,913	129,779	159,687
F	Elite	-	-	-	118,329	102,369	111,391	-	-
F	Montego/Cougar	67,878	125,573	130,503	79,634	46,201	-	53,207	35,251
F	Thunderbird	-	-	-	-	-	-	325,153	304,430
F	Torino LTD II	345,131	470,477	433,213	272,363	144,040	191,464	203,922	138,947
	FORD SUBTOTAL	464,542	646,169	622,140	543,183	344,283	430,768	712,061	638,315
GM	Chevelle Malibu	399,510	374,448	369,594	345,591	285,726	334,267	296,193	374,124
GM	F-85/Cutlass	305,086	334,826	366,474	276,399	342,875	514,593	527,939	520,279
GM	Grand Prix	75,800	103,989	145,361	80,906	101,829	251,952	235,833	224,195
GM	Lemans	181,588	198,969	218,740	128,689	93,382	89,178	73,061	125,020
GM	Monte Carlo	154,802	212,387	300,914	284,867	278,826	376,621	370,825	355,058
GM	Skylark/Century/Regal	209,815	232,639	252,823	155,887	195,399	294,989	279,657	323,356
	GM SUBTOTAL	1,326,601	1,457,258	1,653,906	1,272,339	1,298,037	1,861,600	1,783,508	1,922,032
	TOTALS	2,393,145	2,726,499	2,851,217	2,162,093	2,058,059	2,706,213	2,959,646	3,007,772

NOTES: Elite was part of Torino
Fury was Satellite

Source: References 1, 2, 5.

Luxury car sales (see Table 1-7) followed a similar sales trend of losing sales during the "Energy Crisis" and recession years, and recovering sales from 1976 through 1978.

Passenger van sales (see Table 1-8) showed a steady growth trend from 1971 to 1978. Sales of these vehicles were apparently unaffected by the energy crisis and recession.

Annual imported car sales (see Tables 1-9 and 1-10) grew 185,000 vehicles between 1971 and 1973. In 1974, sales were 350,000 vehicles lower than the 1973 figure. However, in 1975, at the height of the recession, import sales were 170,000 vehicles higher than in 1974. Import sales were down again in 1978 due to the increase in the domestic subcompact sales and the problems with the U.S. dollar.

Overall total passenger car sales (see Table 1-1) grew from 1971 to 1973, fell in 1974 and 1975, and recovered in 1976 to 1978.

Except for a slight decline in 1975, light truck sales (see Tables 1-1 and 1-11) grew steadily from 1971 through 1978. Class I and Class II truck sales increased steadily and rapidly from 1971 through 1978 due, for the most part, to the growth in pickups.

1.4 MARKET SHARE

Although the market segmentation (see Figure 1-2 and Table 1-12) was relatively stable during the 1960's, truck sales began to rise at a much faster rate than cars in the late 1960's. In the 1970's, these shifts have become even more pronounced. The car/light truck split, which was an 86 percent and 14 percent split in 1971, became, by 1978, a 76 percent and 24 percent split.

While the import car market share remained relatively stable from 1971 to 1978, the domestic car share fell from 73 percent in 1971 to 62 percent in 1978 due to losses in the market share of the full-sized car. The light truck market share, which gained approximately 2/3 of the full-sized car market share loss (Figure 1-3), rose steadily from 14 percent in 1971 to 24 percent in 1978.

TABLE 1-7. LUXURY RETAIL CAR SALES, BY YEAR

LUXURIES	1971	1972	1973	1974	1975	1976	1977	1978
C Imperial	12,982	15,033	13,019	12,205	4,909	-	-	-
CHRYSLER SUBTOTAL	12,982	15,033	13,019	12,205	4,909	-	-	-
F Lincoln	36,793	47,447	50,415	38,574	52,747	63,781	92,985	97,009
F Mark III, IV, V	31,583	52,858	67,621	48,530	43,755	58,222	74,807	75,731
F Versailles	-	-	-	-	-	-	13,490	15,747
FORD SUBTOTAL	68,376	100,305	118,036	87,104	96,502	122,003	181,282	188,487
GM Cadillac	229,580	227,360	238,905	187,162	194,600	223,602	244,770	248,825
GM Corvette	25,364	26,652	29,661	29,570	40,607	41,673	42,571	42,247
GM Eldorado	38,288	41,767	50,328	36,682	45,918	39,635	46,348	46,267
GM Seville	-	-	-	-	26,531	41,248	44,667	55,721
GM SUBTOTAL	293,232	295,779	318,894	253,414	307,656	346,158	378,356	393,060
TOTALS	374,590	411,117	449,949	352,723	409,067	468,161	559,638	581,547

Source: References 1, 2, 5.

TABLE 1-8. PASSENGER VAN SALES, BY YEAR

PASSENGER VANS		1971	1972	1973	1974	1975	1976	1977	1978
C	Sportsman	24,488	34,696	46,391	39,626	39,402	43,266	45,380	44,376
C	Voyager	-	-	-	12,174	12,928	12,974	13,767	13,895
	CHRYSLER SUBTOTAL	24,488	34,696	46,391	51,800	52,330	56,240	59,147	58,271
F	Club Wagon	20,587	21,641	21,288	20,340	28,324	32,942	38,761	45,964
	FORD SUBTOTAL	20,587	21,641	21,288	20,340	28,324	32,942	38,761	45,964
GM	Sport Van	17,073	18,182	19,024	20,049	23,432	30,337	39,609	43,582
	GM SUBTOTAL	17,073	18,182	19,024	20,049	23,432	30,337	39,609	43,582
	TOTALS	62,148	74,519	86,703	92,189	105,086	119,519	137,517	147,817

Source: References 1, 4.

TABLE 1-9. IMPORT PASSENGER CAR SALES (CAPTIVES AND TOURIST DELIVERIES), BY YEAR

	1971	1972	1973	1974	1975	1976	1977	1978
Captive Imports	205,888	211,428	223,642	178,694	152,324	119,359	213,336	202,738
Tourist Deliveries	27,241	27,705	15,489	9,758	7,068	8,034	10,136	8,998
Other Imports	1,330,049	1,374,573	1,508,930	1,210,629	1,412,080	1,371,360	1,850,918	1,788,179
Total All Imports	1,563,178	1,613,706	1,748,061	1,399,081	1,571,472	1,498,753	2,074,390	1,999,915

Source: References 1, 6.

TABLE 1-10. CAPTIVE IMPORT RETAIL PASSENGER CAR SALES, BY YEAR

CAPTIVE IMPORTS	1971	1972	1973	1974	1975	1976	1977	1978
C Arrow/Champ	-	-	-	-	-	30,430	47,345	28,296
C Challenger	-	-	-	-	-	-	1,832	17,649
C Colt	28,381	34,057	35,523	42,925	60,356	48,542	70,679	44,570
C Cricket*	27,682	13,888	4,819	-	-	-	-	-
C Rootes	330	-	-	-	-	-	-	-
C Sapporo	-	-	-	-	-	-	1,406	12,777
C Simca	4,778	-	-	-	-	-	-	-
CHRYSLER SUBTOTAL	61,171	47,945	40,342	42,925	60,356	78,972	121,262	103,292
F Capri	56,118	92,521	113,069	75,260	54,585	29,904	22,453	4,079
F Cortina	757	-	-	-	-	-	-	-
F Fiesta	-	-	-	-	-	-	40,549	76,145
F Pantera	130	1,552	1,831	1,230	490	-	-	-
FORD SUBTOTAL	57,005	94,073	114,900	76,490	55,075	29,904	63,007	80,224
GM Opel	87,712	69,410	68,400	59,279	36,893	10,483	29,067	19,222
GM SUBTOTAL	87,712	69,410	68,400	59,279	36,893	10,483	29,067	19,222
TOTALS	205,888	211,428	223,642	178,694	152,324	119,359	213,336	202,738

*Cricket Phased Out in 1971

Source: References 1, 6.

TABLE 1-11. COMPACT IMPORTED PICKUP NEW RETAIL TRUCK SALES, BY YEAR, NON-CAPTIVE AND CAPTIVE

	IMPORT	1971	1972	1973	1974	1975	1976	1977	1978
	Datsun	66,655	73,871	87,816	60,111	71,361	80,300	99,834	94,604
	Mazda	844	4,881	14,044	9,223	9,535	5,829	4,556	4,696
	Toyota	14,974	15,363	37,466	31,243	44,450	49,823	83,680	94,882
	Volkswagen	2,025	485	247	101	-	-	-	-
	NON-CAPTIVE SUBTOTAL	84,498	94,600	139,573	100,678	125,346	135,952	188,070	194,182
C	Arrow	-	-	-	-	-	-	-	1,215
C	D 50	-	-	-	-	-	-	-	1,929
	CHRYSLER CAPTIVE SUBTOTAL	-	-	-	-	-	-	-	3,144
F	Courier	-	29,958	53,303	44,491	56,073	54,589	65,755	70,557
	FORD CAPTIVE SUBTOTAL	-	29,958	53,303	44,491	56,073	54,589	65,755	70,557
GM	Luv	-	21,098	39,422	30,328	46,678	45,670	67,539	67,035
	GM CAPTIVE SUBTOTAL	-	21,098	39,422	30,328	46,678	45,670	67,539	67,035
	CAPTIVE SUBTOTAL	-	51,056	92,725	74,819	102,751	100,259	133,294	140,736
	TOTALS	84,498	145,656	232,298	175,497	228,097	236,211	321,364	334,918

Source: References 1, 6.

TABLE 1-12. MARKET SEGMENT SHARES, BY YEAR (PERCENT)

	1971	1972	1973	1974	1975	1976	1977	1978
IMPORT CARS	13.1	12.4	12.4	12.6	14.6	11.6	14.3	13.4
DOMESTIC CARS								
Subcompact	6.4	6.9	7.6	9.7	10.1	7.7	6.6	8.1
Compact	13.3	12.3	14.1	16.0	17.1	17.9	15.4	14.8
Intermediate	20.0	20.9	20.2	19.5	19.0	20.9	20.4	20.1
Full-Sized	29.6	27.2	24.1	17.8	14.3	15.4	15.7	14.3
Luxury	3.1	3.2	3.2	3.2	3.8	3.6	3.9	3.9
Passenger Vans	0.5	0.6	0.6	0.8	1.0	1.0	0.9	1.0
DOMESTIC TOTALS	72.9	71.5	69.8	67.0	65.3	66.4	62.9	62.2
TOTAL PASSENGER CARS (DOMESTIC AND IMPORTS)	86.0%	83.9%	82.2%	79.6%	79.8%	78.0%	77.2%	75.5%
LIGHT TRUCKS (0-10000 Lbs)								
Imported	0.8*	1.1*	1.6*	1.6	2.1	1.8	2.2	2.2
Conventional & Cartype Pickup	9.6*	10.4*	11.6*	12.9	11.9	13.7	13.9	14.4
Vans and Multistors	2.1*	2.8*	2.7*	3.2	3.7	4.3	4.2	4.8
Utilities	1.1*	1.2*	1.3*	1.4	1.5	1.6	1.7	2.4
Station Wagons (Truck Chassis)	0.5*	0.5*	0.7*	0.6	0.5	0.6	0.6	0.7
TOTAL LIGHT TRUCKS	14.1%	16.0%	17.9%	20.4%	20.2%	22.0%	22.0%	24.5%
TOTALS	100.1%	99.9%	100.1%	100.0%	100.0%	100.0%	100.0%	99.9%

*Market segment shares based on factory sales and are therefore estimates of retail sales market segments. All other market segment shares are based on retail sales.

Source: References 1, 2, 3, 4.

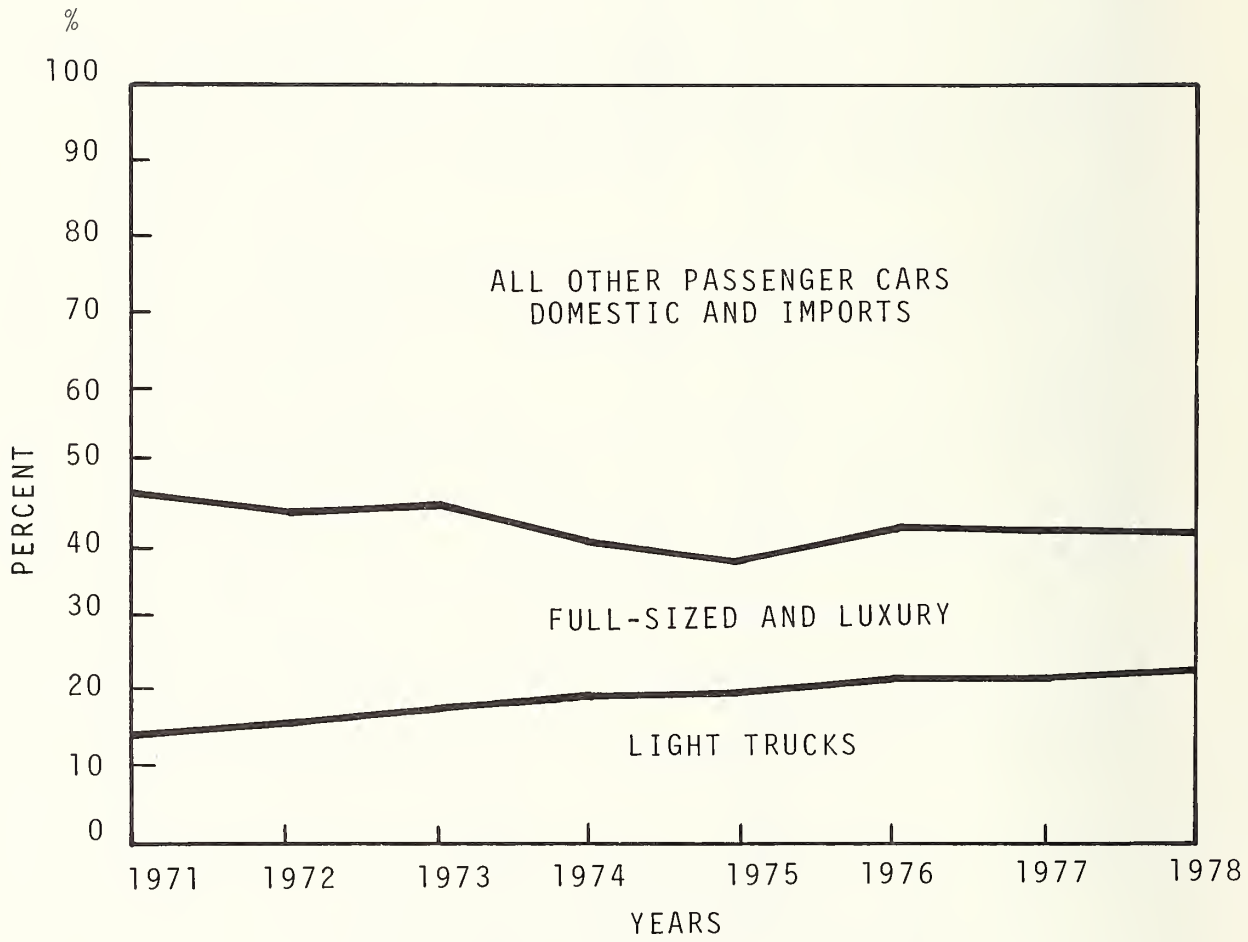
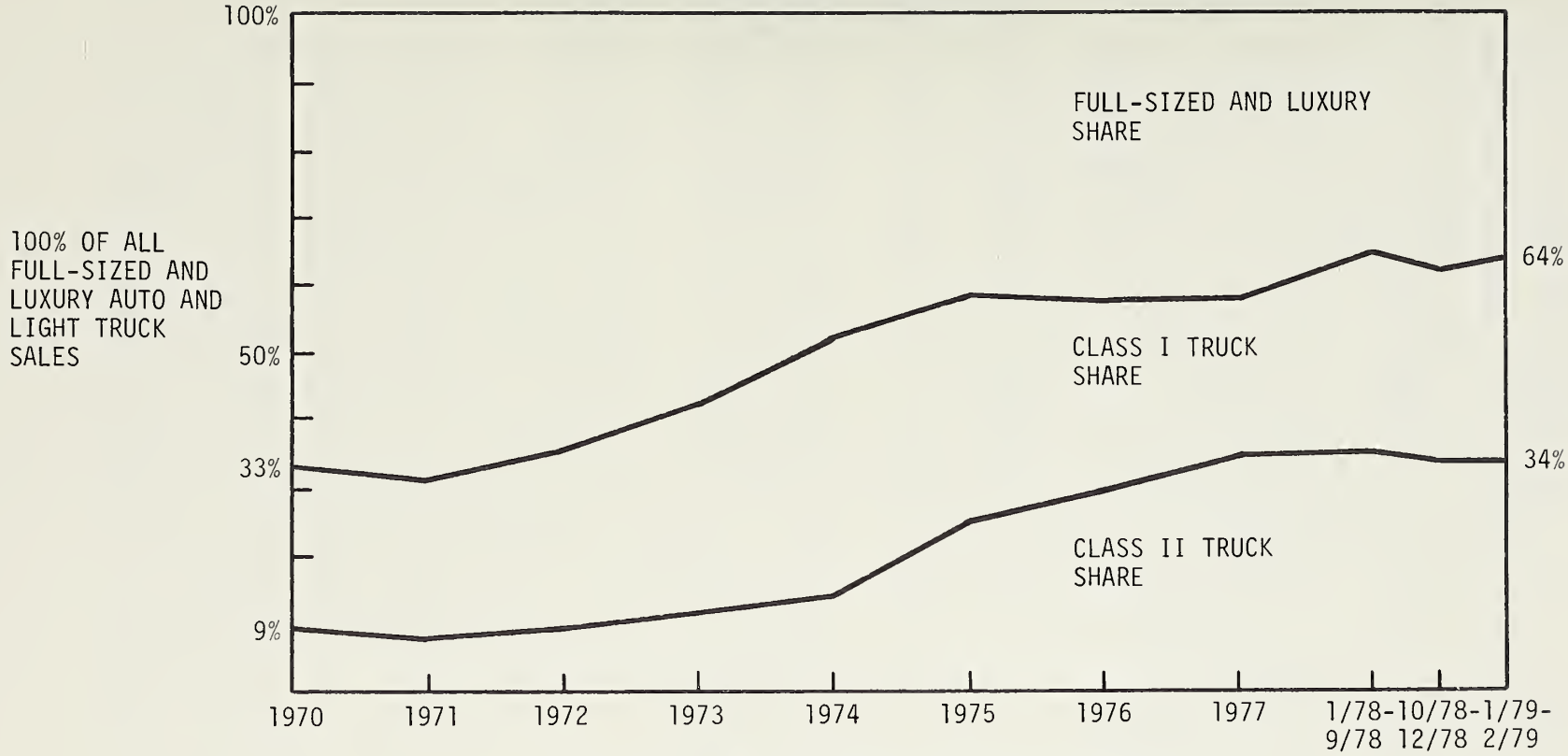


FIGURE 1-2. MOTOR VEHICLE MARKET SHARES



Source: TSC MONTHLY SALES REPORTS.

FIGURE 1-3. FULL-SIZED AND LUXURY CAR AND LIGHT TRUCK SHARES OF FULL-SIZED AND LUXURY CAR AND LIGHT TRUCK SALES, 1970 THROUGH 1979

The full-sized car share (see Figure 1-2), which had been 30 percent in 1971, fell to 24 percent in 1973 and 18 percent in 1974. By 1978, the full-sized car share was 14 percent, an indication that some consumers wanted a smaller, more fuel efficient automobile, while other consumers preferred a light truck.

The market share for subcompact cars in 1971 was 6 percent and rose steadily to a high of 10 percent in 1975. This significant increase in the subcompact market share was the result of the uncertainty of gasoline availability brought on by the oil embargo of 1973 and 1974, the steadily rising gasoline and car prices, and losses in the full-sized car share. The market share dropped to 6.6 percent in 1977 but rose to 8.1 percent in 1978.

The compact market share, which also benefited from the full-sized car share losses, rose from 13 percent in 1971 to a high of 18 percent in 1976. In 1978, however, the compact share declined slightly to 15 percent.

The intermediate and luxury market shares remained relatively flat from 1971 through 1978. During that time period, the intermediate share remained around 20 percent, while the luxury share rose from 3 percent to 4 percent.

The passenger van market share showed very little variation from 1971 to 1978. In 1971, the share was 0.5 percent; it rose to and remained at 1.0 percent from 1975 through 1978.

The 1971 to 1978 market share increase in light trucks was due to the substantial market share increases in the domestic pickups and the vans. The market share for the pickups rose from 10 percent in 1971 to 14 percent in 1978, while the van share increased from 2 percent in 1971 to 5 percent in 1978. The import pickup market share rose from 0.8 percent to 2.2 percent from 1971 through 1978. The utility share rose from 1.1 percent in 1971 to 2.4 percent in 1978, while the station wagon share was almost flat.

1.5 REFERENCES FOR SECTION 1

1. Ward's Automotive Yearbooks, 1971 through 1978.
2. Market Data Books, Automotive News, 1970 through 1978.
3. "Motor Vehicle Facts and Figures," 1974 through 1978, Motor Vehicle Manufacturers Association.
4. "Motor Vehicle Sales and Prices," August, 1977 through December, 1978, U.S. Department of Transportation, Transportation Systems Center Memoranda.
5. "Passenger Car Retail Sales in the U.S.," Reported by U.S. Manufacturers, RS-1000, Motor Vehicle Manufacturers Association.
6. Ward's Automotive Report, 1/8/79.

2. FLEET LIFE AND FLEET COMPOSITION ANALYSIS*

2.1 INTRODUCTION

The composition of the registered fleet with respect to vehicle age, "survivability,"** and physical characteristics is a significant input to an overall analysis of the impact of consumer behavior toward car and light truck ownership. Fleet life and fleet composition analysis addresses the dynamics of the composition of the registered fleet with respect to age, survivability, and physical characteristics.

The auto/light truck-consuming public is quite heterogeneous with repsect to life style and income. This heterogeneity spawns differences in vehicle requirements in terms of acquisition and operating costs, physical characteristics (carrying capacity, performance), durability, and reliability. Thus, it is important to recognize that impacts of changes in new vehicle offerings and in the composition of the existing fleet will be felt differently by different consumer classes.

The differences among consumer classes manifest themselves in regional and local variations. Fleet life and fleet composition analysis can address regional and local variations in fleet composition dynamics.

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*This section covers fleet life and fleet composition between 1966 and 1977, with updates to 1978. The primary research for this section was performed in the fall of 1978.

**Motor vehicle survival rate is the proportion of vehicles which remain within the registered fleet during a fixed period of time. Hence, "survivability" is a motor vehicle's capacity to remain within the fleet over time, i.e., not be scrapped, or, more precisely, deregistered. A distinction between scrappage and deregistration must be made. For example, a vehicle may be deregistered and not be scrapped, but be used as an off-road vehicle. Deregistration is the measure used in this report.

The purpose of this analysis is to quantitatively study: (1) the variations in fleet life of motor vehicles with various physical characteristics (engine size, body style, etc.) operated in various areas of the country and (2) regional differences with respect to the proportion of vehicles of various ages and physical characteristics (fleet composition) within the regions' local fleets. The life of a vehicle is the expected time that the vehicle will remain registered in the United States.

The basic data employed are motor vehicle registration data -- produced annually since 1922 by R.L. Polk and Company. Since July 1, 1975, the Polk Co. has produced the National Vehicle Population Profiles (NVPPs), a more detailed census of the registered motor vehicle fleet. The NVPP data base permits disaggregation of vehicles by physical characteristics:

a. truck, domestic auto, imported auto;
b. make (i.e., Ford, Dodge, etc.);
c. series (i.e., the Dodge Aspen series);
d. model (i.e., the Dodge Aspen Custom Model);
e. engine size:
    - cubic inch displacement (CID)
    - number of cylinders
    - number of carburetors
    - high performance versus other
f. model year;
g. body style;
h. fuel type;
i. gross vehicle weight (GVW) - trucks only;
j. regional levels:
    - national
    - state
    - county.

2.2 SUMMARY OF AFER-RELATED PRELIMINARY FINDINGS

This section presents a summary of the Automobile Fuel Economy Regulations (AFER)-related preliminary findings. A broader discussion of these and other preliminary findings can be found in Sections 2.3. and 2.4.

a. Trucks Last Longer Than Cars

Conserving fuel means replacing the current fleet with progressively more fuel efficient fleets. Hence, rapid fleet turnover, while increasing consumer cost of ownership and operation, benefits the conservation effort. Trucks last longer in the fleet than cars. This difference has fluctuated over time. The latest data, 1976-77, show this difference to be at a low ebb. Analysis of motor vehicle fleet life indicates that light trucks last longer than cars primarily because of the much longer expected life of pickups (see Table 2-13). Thus, there may be a trend towards substitution of truck-for-car within the personal transport market, aiding fuel conservation efforts. As trucks in general last longer and have poorer fuel economy than autos, this trend may negatively impact fuel conservation efforts.

b. Increased Survival of the "Old Car"

Preliminary analysis shows a trend toward increased survival of cars between ages 6-15 years, during the period 1969-77. This may represent a consumer response to inflationary pressures inside and outside the transport sector. The consumer may be attempting to cut cost while maintaining/expanding mobility. Slower fleet turnover, however, negatively impacts fuel conservation efforts.

c. Post-1974 Truck Market Volatility

In 1974-75 truck life expectancy was at an 8-year high while 1975 truck sales dipped below 1972 levels. By 1977, sales were at an all-time high, and life expectancy dipped to the lowest level in at least eight years. The rush to scrap-and-buy in 1977 may have been due to a combination of makeup sales and anticipation sales in view of regulations.

d. The West is More Highly Truck Dependent

The West has a significantly greater porportion of trucks in its fleet than the East. The implication is that AFER regulation of light trucks will more severely impact and arouse greater resentment from the western states.

2.3 FLEET LIFE

2.3.1 Methodology

Fleet life analysis examines a defined subpopulation of the motor vehicle fleet, i.e., all Chevrolets, all cars, all trucks, all light trucks and cars, all sedans, all Chevrolet Sedans in the State of New York, or any subpopulation of the fleet definable within the NVPP data. The subpopulation is segmented into age group components. The methodology analyzes the survival rates of the age components of the subpopulation and presents an overall picture of the durability of the motor vehicle subpopulation.

The methodology employed is a life table analysis modified to be applicable to the NVPPs. The life table is a convenient construct which permits interpopulation comparisons of mortality characteristics during a given period of time. "Mortality characteristics" are described from the standpoint of an individual; they are the changing probability of death as the individual ages. Mortality characteristics are thus independent of the fertility characteristics of the population, the age distribution within the population, and the size of the population. The life table describes the population that would exist if (1) current age-specific mortality rates continued indefinitley and if (2) there were 100,000 births annually. The life table reflects the equilibrium state achieved by a population under the above two criteria. Note that the "equilibrium state population" consists of hypothetical individuals whose mortality characteristics are composites of the individuals' mortality characteristics in the existing population; the mortality characteristics of an x-year old in the "equilibrium state

population" do not reflect the mortality experience of real people first born x years ago, from x years ago to the present. Instead, this x-year old reflects the mortality experience of current new borns, 1-year olds, 2-year olds, ... x-year olds during, for example, the past year.

The parameters included in a life table are:

${}_nq_x$ = the probability that an individual age x will die between age x and age x + n.

ℓ_o = size of the cohort* which is age zero ≡ 100,000.

ℓ_x = size of the cohort at age x ≡ 100,000 multiplied by the probability of surviving from birth to at least age x.

${}_nL_x$ = expected number of person-years** to be lived by the cohort currently age x, between ages x and x + n $\equiv \int_x^{x+n} \ell(t)dt$.

$\overset{o}{e}_x$ = expected life of an individual age x.

T_x = expected number of person-years to be lived by the cohort currently age x.

Notes: *A cohort is defined as a group of individuals with a statistical factor in common, such as year of birth. Please note that this cohort is hypothetical under the conditions described above.

**A person-year is one person surviving one year; i.e., if there are 70,000 persons in the cohort of age sixty-five, and (1) all but 10% survive to age seventy, and (2) these 10% die on their sixty-eighth birthday, the number of person-years lived multiplied by the cohort age 65, between ages 65 and 70, is (.90) x 70,000 x 5 + (.10) x 70,000 x 3 = 336,000.

2.3.2 Applicability of Life Table Analysis to Motor Vehicle Survival in the Fleet

Motor vehicle age-specific survival rates are not constant from year to year (see Table 2-1). The question may therefore be asked: What is the usefulness of life tables which reflect the equilibrium state achieved by a hypothetical population of motor vehicles with current age-specific survival rates?

And, further, how can such life tables be used to indicate impacts of federal regulation of the automotive industry on consumers?

This section attempts to answer the above questions by:

- offering a classification scheme for the factors influencing motor vehicle survival;
- showing that life table analysis is a useful technique for isolating the effects of factors on two or more vehicle subpopulations, thereby permitting analysis of the sources of variation in the surviving patterns;
- showing how federal regulations impact the factors influencing motor vehicle survival, thereby permitting the development of federal regulation impact test hypotheses.

TABLE 2-1. EXAMPLES OF AGE SPECIFIC SURVIVAL RATES*

YEAR BEGINNING 1 JULY	ONE YEAR SURVIVAL RATES FOR CARS AT AGE 4	AT AGE 10
1976	.969	.795
1975	.965	.813
1974	.982	.813
1973	.970	.764
1972	.964	.739
1971	.965	.722
1970	.974	.733
1969	.960	.690
1968	.983	.695
1967	.983	.726

*Based on TSC analysis.

2.3.2.1 Factors Influencing Motor Vehicle Survival - The rate of motor vehicle scrappage is influenced directly by wear and tear of operation and accidents, and indirectly by demographic and economic

factors. Economic factors tend to be most influential in year-to-year fluctuations observable in the motor vehicle survival data.

Wharton Econometric Forecasting Associates (WEFA), in its auto sales forecasting model, shows the influence of these externalities, i.e., economic and demographic factors. WEFA develops a relationship between new car sales, the existing fleet of registered vehicles, motor vehicle scrappage, and a set of economic factors. The level of auto ownership desired by the American public is said to vary with economic factors. New car sales and motor vehicle scrappage rates vary to accommodate this desired state. The economic factors cited by Wharton as impacting motor vehicle survival are changes in:

a. economic factors:

- auto operating and purchase costs
- income and income distribution
- unemployment rate
- old car prices relative to scrap metal price index;

b. demographic factors:

- family size
- population migration
- age distribution of the population
- degree of urbanization/suburbanization
- number of licensed drivers
- non-auto commuting.

Economic factors affect the economics of the decision to repair/replace a vehicle. Demographic factors affect household needs with respect to type, number, and reliability of automobiles and household utilization patterns. Utilization and type, as previously mentioned, affect vehicle survivability. Reliability requirements affect the decision to replace/repair a vehicle.

Wear and tear of operation and accidents result from the operator operating the vehicle within an environment. Hence, vehicle failure is attributable to human limitations, vehicle and environmental design, and the human/vehicle/environment interface.

Factors directly influencing the rate of motor vehicle scrappage may, therefore, be categorized as follows:

a. automobile physical characteristics and their resistance to wear and tear;

b. degree to which the automobile has been subject to wear and tear reflected in:

   - age of the vehicle
   - miles driven
   - maintenance practices
   - operating environment;

c. likelihood and severity of accidents which are a function of:

   - skills of drivers
   - operating environment
   - vehicle safety features;

d. degree to which the automobile has been exposed to accidents:

   - vehicle age
   - vehicle miles operated in environment.

2.3.2.2 Life Table Analysis Experimental Design - It can thus be seen that a complex array of factors affects vehicle survivability. To understand the utility of life table analysis for helping to indicate casuality between impact factor and vehicle survivability, it is important to note that life table statistics are derived from registered motor vehicle fleet data at two instants in time: July 1 of the base year and July 1 of the succeeding year. Hence, the effects of impact factors observable in life tables are effectively "smoothed" over a one year period. Thus, impact factor parameters must be measured by average annual values. These

average values may be taken as constant over the year.*

With a shopping list of impact factor parameter values ready to be correlated with survivability statistics, two types of experiments can be designed. The first type looks only at a single time frame. Motor vehicle subpopulations are chosen that are known to have distinct differences among the factors influencing motor vehicle survival, to observe the degree of influence of the factors, i.e., survival of rural versus urban fleets, survival of large versus small cars, etc. Or, conversely, one may examine two vehicle subpopulations to test whether there is a difference in survival rates between them. One can then look for the factors creating such differences. The second type of experiment looks at successive time frames to observe trends in motor vehicle survival among distinct motor vehicle subpopulations. The trends may then be correlated with changes occurring in one or more factors.

2.3.2.3 Testing the Impact of Federal Regulations - Impacts of federal regulations are of two basic types: (1) impacts on marketability of products and as a corollary, intra-industry competition, and (2) impacts on consumer mobility and life style. Increased transport cost or reduced passenger and/or load-carrying capacity resulting in either reduced consumer mobility or increased transport expenditure vis-a-vis other expenditures are examples of consumer impacts. Federal regulations (CAFEs, EPA emission standards) impact the physical characteristics of the motor vehicles which in turn may affect: (1) their wear and tear characteristics; (2) their maintenance requirements; (3) the utility of available motor vehicles which may in turn affect use patterns and vehicle miles driven; (4) economic factors such as acquisition and operating costs, and the value of used cars vis-a-vis new

*One assumes that the within-year volatility of the parameter does not have an impact apart from the parameter's value. Should the within-year volatility of a parameter have an impact apart from the parameter value, one would ideally want to compare a situation of high parametric volatility with a situation of low parametric volatility. At a minimum one would note the volatility level of the parameter.

cars; and (5) consumer demand for new motor vehicles and/or manufacturer market share of new car sales.

To test the impact of federal regulations it will be necessary to develop an understanding of the dynamics of the composition of the registered fleet through more generally directed fleet life and fleet composition analyses. Fleet composition and fleet life analyses must be done in conjunction with demographic/economic/social analyses to understand the interactive processes of life style, demography, economics, and the registered fleet. Within this context, AFER's impacts may be more accurately assessed.

2.3.3 Constructing Life Tables for Motor Vehicles

2.3.3.1 Computational Procedures - Life tables may be constructed for any subpopulation of the U.S. motor vehicle fleet defined by the NVPPs. Age-specific scrappage data at the local, state, regional, and national levels are derived from the comparison of two successive NVPPs. One can observe, for example, that the 1975 NVPP shows 1,650,801 model year 1971 Chevrolets registered nationally,* whereas the 1976 NVPP shows 1,593,512. One can then estimate that nationally the proportion of four-year old Chevrolets surviving to age five was 0.965 during the period 1975-1976. (Note that model year is not an exact "birth date," hence, one "estimates" proportion surviving one year.) The estimates of age-specific survival probabilities are referred to herein as $_xS_{x+1}$, the probability of surviving from age x to age x + 1. In a similar manner, one can estimate the probability of surviving from age 0 to age 1, age 1 to age 2, etc. One can estimate the probability of a new vehicle surviving to any given age x as the product of probabilities of survival from age 0 to age 1, age 1 to age 2, ..., age x-2 to age x-1, age x-1 to age x. For example:

$$_0S_x = {}_0S_1 \times {}_1S_2 \times {}_2S_3 \cdots {}_{x-1}S_x.$$

* Excludes Oklahoma

This probability of survival to age x represents a probability of survival to age x given that current conditions influencing the rate of survival continue for at least another x years.

Life table statistics, such as expected life, can then be used as single aggregate measures of changes/variations that occur within the survival patterns of automobiles. The more disaggregate elements of the life table (ℓ_x, $_1L_x$, and T_x in Table 2-2) can be examined in time series, compared among regions/states/localities or between subpopulations of the American fleet, and correlated to demographic, economic, and other conditions.

The method of computing life table parameter values used in this analysis is shown in Table 2-2.

2.3.3.2 Data Limitations and Their Implications for Life Table Procedures - There are limitations within the data for which computational assumptions must be made.

The NVPPs show the number of vehicles of model year x registered as of July 1 of the year of the NVPP. The NVPPs do not show: (a) the exact date when the vehicle was first registered (the "birth date"), or (b) given that the vehicle was scrapped during the period of observation, exactly when during the year the vehicle was scrapped (the date of "death"). Thus, it is not possible to directly obtain a continuous function describing the probability of survival from age 0 to age x. Recall that ℓ_x, the size of the cohort at age x, is computed as the probability of survival from age 0 to age x, multiplied by 100,000. The assumption is made that all vehicles of model year x are first registered on

TABLE 2-2. METHOD OF COMPUTING LIFE TABLE PARAMETERS FROM NVPP DATA

${}_{s}V_{m}^{y}$	=	number of vehicles (V) in the motor vehicle subpopulation s of model year m listed in the NVPP of year y.
${}_{x}S_{x+1}$	=	probability of an x year old vehicle surviving to age x + 1 = ${}_{s}V_{m}^{y+1}$ / ${}_{s}V_{m}^{y}$ such that y - m = x.
ℓ_x	=	size of hypothetical life table cohort at age x = $100{,}000 \times \prod_{i=0}^{x-1} {}_{i}S_{i+1}$.
${}_{1}L_{x}$	=	expected number of vehicle-years of registered fleet life of the cohort age x = ℓ_{x+1}.
$\overset{o}{e}_x$	=	expected life of a motor vehicle age x = $\sum_{i=x+1}^{\infty} \frac{\ell_{x+1}}{\ell_x}$.
T_x	=	expected number of vehicle-years of registered fleet life of the cohort of vehicles currently age x = $\overset{o}{e}_x \ell_x$.

July 1 of year x. A vehicle scrapped while age n is assumed scrapped on July 1 of year x + n. "ℓ_x" is then defined for x = 0, 1, 2, 3,... by the $\{{}_xS_{x+1}\}$ as shown in the table. It is further assumed that the ℓ_x is a step function such that $\ell_x = \ell_n$ for $n<x\leq n+1$, so that ${}_1L_x = \int_x^{x+1} \ell(t)dt = \ell_{x+1}$.

Note that not all eventually registered vehicles of model year x are registered by July 1 of year x. Thus, for two successive NVPPs, there will be more vehicles of model year x in the NVPP for year x + 1 than for year x. The survival rate of vehicles from age 0 to age 1 would thus appear to be greater than 1. This is, of course, absurd! It is therefore assumed that all vehicles age 0 survive to age 1. It is clearly not possible to discuss scrappage occurring during the first year of a vehicle's existence from the NVPP data.

Another inherent limitation in the data exists with respect to the level of disaggregation of vehicle description available for the older model years. The domestic car data are cross-classified by make, series, model, engine characteristics, model year, body style, and fuel type back to 1966.

In specified NVPP data, only make and model year can be distinguished for the following model years:

a. 1975 NVPP -- MY 1960-65,
b. 1976 NVPP -- MY 1961-65,
c. 1977 NVPP -- MY 1962-65.

Only make can be distinguished in:

d. 1975 NVPP -- prior to 1960,
e. 1976 NVPP -- prior to 1961,
f. 1977 NVPP -- prior to 1962.

For import vehicles, detailed data exist back to 1966 in the 1975, 1976, and 1977 NVPPs. Prior to 1966, in the 1975, 1976, and 1977 NVPPs, only make can be distinguished. For light trucks, detailed data exist back to 1966 in the 1975, 1976, and 1977 NVPPs. Between 1960-1965 in the 1975 NVPP, 1961-1965 in the

1976 NVPP, and 1962-1965 in the 1977 NVPP, only make and model year can be distinguished. Prior to 1960 in the 1975 NVPP, 1961 in the 1976 NVPP, and 1962 in the 1977 NVPP, only make can be distinguished. Light trucks cannot be distinguished from trucks of other gross vehicle weight classes prior to 1966. Hence, it is impossible to determine the total number of light trucks registered in the U.S. from the Polk data.

The aforementioned data limitations are significant in that there is a considerable number of vehicles on the road which cannot be classified, even with respect to model year. The estimation of survival probabilities for these vehicles requires special estimation procedures. These special estimation procedures are described in Appendix 2A to this chapter.

2.3.4 Preliminary Fleet Life Analysis Results

2.3.4.1 A Sample Complete Life Table - Table 2-3 shows a complete life table for the registered automobile fleet during the period July 1, 1976 to July 1, 1977.

The expected number of years that a vehicle will remain in the fleet declines as the vehicle gets older. On the average*, a new vehicle can expect to remain in the fleet 9.8 years ($\overset{o}{e}_0$). A vehicle that has survived to age 14 will on the average survive an additional 2.1 years ($\overset{o}{e}_{14}$).*

One year survival rates among the various age groups show that the proportion of surviving vehicles declines as the age of the cohort increases. 100% ($_1S_0$)* of new cars are expected to survive their first year.** 75% ($_1S_{14}$)* of 14-year-old cars are expected to survive their 14th year.

It is obvious that the probability of a new car surviving to a given age x declines as x increases. Hence, the rate per 100,000 new cars of survival to age x (ℓ_x) declines as x increases. The rate of new car survival to age 1 is 100,000 (ℓ_1).* The rate of new car survival to age 15 is 13,585 (ℓ_{15}).

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* Assumes 1976-1977 motor vehicle survival conditions continue ad infinitum.

** A vehicle year is one vehicle surviving one year.

TABLE 2-3. LIFE TABLE FOR TOTAL U.S. FLEET FROM 1976-1977

AGE x	$_xS_{x+1}$ [1]	$\ell_{x+1}(L_x)$ [2]	T_x [3]	e_x^o [4]
0	1.000	100,000	980,791	9.8
1	0.973	97,319	880,791	8.8
2	0.984	95,807	783,472	8.1
3	0.975	93,435	687,665	7.2
4	0.969	90,512	594,230	6.4
5	0.954	86,304	503,718	5.6
6	0.935	80,700	417,414	4.8
7	0.896	72,279	336,714	4.2
8	0.855	61,765	264,435	3.7
9	0.824	50,875	202,669	3.3
10	0.795	40,456	151,794	3.0
11	0.771	31,174	111,338	2.8
12	0.764	23,809	80,164	2.6
13	0.756	17,992	56,354	2.4
14	0.755	13,585	38,362	2.1

1. P of survival to age x + 1 of an x-year old
2. Rate per 100,000 new cars of survival to age x
3. Expected vehicle years of life of cohort
4. Expected remaining life.

Source: Reference 1.

The older the cohort becomes: (1) the smaller it becomes, and (2) in general, the smaller the proportion of vehicles that survive an additional year. Hence, the "total fleet life" occurring within a cohort over a one year period declines as the cohort ages. Annual vehicle-years accruing to a cohort decline from 100,000 ($_1L_0$) for the cohort at age 0 to 13,585 for the cohort at age 14 ($_1L_{14}$).

2.3.4.2 Fleet Life of Trucks and Cars - The preliminary analysis included in this section examines the dynamics of the motor vehicle fleet during the period 1969-1977 from a national aggregate, all trucks and all cars, perspective. Hypotheses for further investigation are suggested in the text concerning the impacts of the AFER Program.

The data used in this section are only as recent as 1977. AFER impacts were only beginning to be felt in 1977; i.e., the first downsized vehicles were introduced in Model Year 1977. However, consumers, aware of the changes to be brought about in products offered by the motor vehicle industry, could respond to this future by changes in their behavior. For example, if the new fuel efficient cars were deemed an inferior product, consumers may have hung on to their vehicles longer. At the same time, it is important to realize that other forces are at work on the automotive fleet: employment levels, inflation, life style changes, price of gasoline, migration, etc.

Fleet life analyses are, thus, a single piece of supporting evidence, and must be considered in the context of other analyses, economic demographics, etc. Only where a consistent picture results from all analyses is there reasonable assurance of a true AFER impact. Nevertheless, fleet life is an important piece of information for an analysis of the automotive market.

Future AFER-impact fleet life analyses might, for example, include an analysis of the GM X-body. One could examine whether GM subcompacts were scrapped faster or slower than the "average" subcompact in the fleet after the introduction of the X-body. Slower scrapping, in combination with poor sales, would indicate consumer rejection of the X-body.

a. Relative Life Expectancy of Trucks Versus Autos

Figure 2-1 and the accompanying Table 2-4 compare the life expectancy of cars versus trucks. The most immediately striking fact is that the life expectancy of trucks is greater than cars. This difference has fluctuated over time. During the period 1976-1977, the difference in life expectancy between cars and trucks declined sharply from 1969-1976 levels. One potential hypothesis explaining the declining difference in life expectancy among cars and trucks is that some convergence exists in the use of trucks and automobiles, resulting in survival rates among trucks similar to those among automobiles.

The following items require further analysis to appreciate more fully the significance of the decline in the difference in life expectancy among cars and trucks. (1) Is the decline a random fluctuation? The implication would be that trucks and cars are essentially independent markets. Future data will be required to answer this question. (2) Is the decline due to a shift within the registered fleet among truck market segments? This question assumes that (a) some truck types have lower life expectancy than others, and (b) there has been a shift toward increased registration of lower life expectancy truck types. (3) What demographic/economic trend(s) may have resulted in a change in the relative survival rates of autos and trucks? Demographic/economic trends may affect use patterns, transportation costs, and/or income available for transportation. Use patterns, transport costs, and/or income available for transportation may, in turn, affect the relative survival rates of autos and trucks.

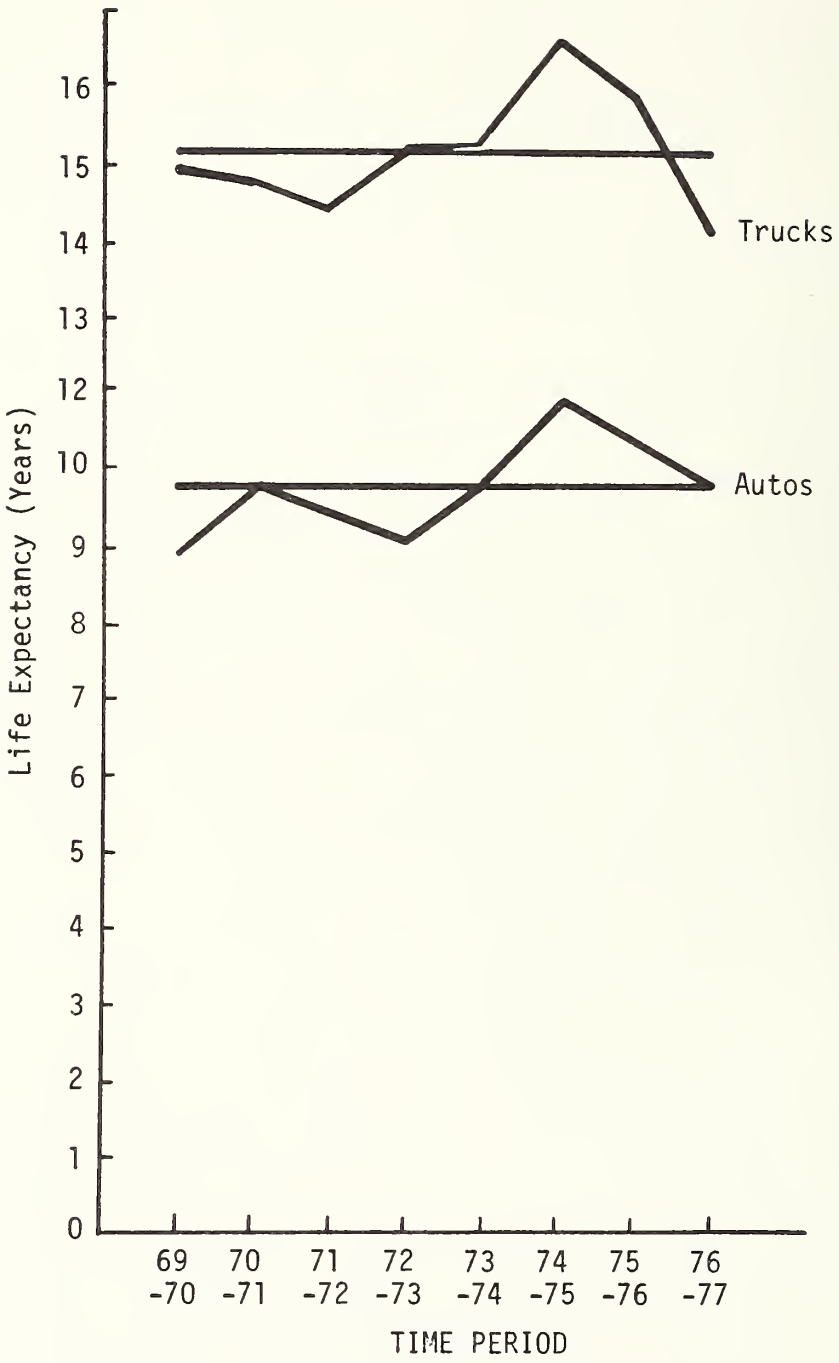


FIGURE 2-1. EXPECTED LIFE OF CARS VS. TRUCKS

TABLE 2-4. EXPECTED LIFE OF CARS VS. TRUCKS ($\overset{o}{e}_o$)

YEAR	ALL CARS	ALL TRUCKS	$\Delta \overset{o}{e}_o$
76 - 77	9.8	13.1	3.3
75 - 76	10.3	14.9	4.6
74 - 75	10.9	15.6	4.7
73 - 74	9.8	14.3	4.5
72 - 73	9.1	14.2	5.1
71 - 72	9.4	13.5	4.1
70 - 71	9.8	13.8	4.0
69 - 70	8.9	13.9	5.0

b. Fluctuations in Motor Vehicle Life Expectancy

Another striking feature of Table 2-4 and Figure 2-1 is the fluctuation in the life expectancy of both cars and trucks over time. A cursory re-examination of the factors influencing motor vehicle life expectancy (Section 2.3.2.1 of this report) reveals that economic factors are those most subject to short term (one-year) fluctuation. Basic demographic changes and changes in the physical design of automobiles and road systems are more likely to take place over the longer term. Demographic changes and physical changes in the transport system are therefore more likely to result in longer term trends.

From 1969 to 1977 the trend in automobile survival has been generally upwards. The trend peaked during 1974-75, just subsequent to the fuel shortage and coincident with the most severe post-war recession. The implications of a slower auto fleet turnover rate are complex. From the standpoint of quick changeover of the fleet to more fuel efficient vehicles, it represents a delay. To consumers, holding on to vehicles longer, longer auto fleet life may represent a more economical solution to their

transport problems under the stress of declining real income and low confidence in the economy.

To segments of low income groups, longer auto fleet life may mean a greater supply of low cost older vehicles with which these groups may meet their transport needs. Conversely, should the new fuel efficient vehicles have a shorter expected life, delay in their replacement by even more fuel efficient vehicles would be reduced. However, assuming the price of these "new fuel efficient vehicles" does not diminish, their depreciation costs would rise. Consumers would be faced with rising transport costs and low income groups relying on used vehicles would have a smaller supply of vehicles from which to choose.

The trend in truck life expectancy between 1969-1975 is up. Subsequent to the 1973-1974 fuel shortage, truck life expectancy peaked. Following the peak, there was a rapid decline in expected truck life. Future data will show whether this is a trend or a fluctuation.* Lower life expectancy means higher depreciation costs to consumers.

c. Fleet Life, Sales, and Registrations

The TSC/WEFA automobile demand model[2] assumes that a desired size and composition of the motor vehicle fleet exists. When there is a gap between the desired and actual state of the fleet, new vehicle purchases and scrappage adjust to move the existing fleet toward the desired state.

Thus, the motor vehicle consuming public has two options to increase the size of its fleet: (1) increase new vehicle sales, or (2) decrease scrappage. The exercise of the options makes sales and scrappage de facto interactive events; purchase can be deferred in favor of reduced scrappage and vice versa. A middle ground, such as increased sales and reduced scrappage, is also possible. This subsection examines the implementation of sales and scrappage options during the period 1969-1977.

*Between 1977 and 1978 there was an increase in expected truck life from 13.1 years to 13.7 years. However, this declined to 13.5 years for 1978-79.

Both truck and auto registrations increased steadily during the period 1969-1977. Sales, on the other hand, have fluctuated greatly. Thus, it is quite evident that the public exercised both its sales and "hold-on" options.

Table 2-5 and Figure 2-2 show that trucks have been steadily gaining in share of total motor vehicle registrations.* Since 1972, new truck sales have led the way in the registration share gain.

Table 2-6 and Figure 2-3 show the relationship of sales, life expenctancy, and registration.** Growth in truck registration averaged 6.9 percent per year. There was considerable fluctuation in the growth rate (compare with auto, Figure 2-4). The difference between auto and truck registration growth rates reflects the difference in character of the two markets. The auto is considered to be a necessity by many Americans, therefore, during hard times sales are deferred and life expectancy rises. The overall fleet grows relatively steadily in accordance with the needs of consumers. Trucks, on the other hand, are at least in part more likely to be a business investment. Thus, during hard times, they may be dispensed with altogether. Hence, truck registration growth has more inherent fluctuation.

Truck sales as a percent of truck registrations measure the significance of the contribution of truck sales to the growth of the registered truck fleet, irrespective of the size of the growth rate. The contribution of truck sales to the size of the

* Table 2-5 and Figure 2-2 exclude buses.

** One should note in looking at Tables 2-5 and 2-6 and Figures 2-2 and 2-3 that life expectancy and percentage growth in registrations are measured over different one-year bases (July 1 - July 1) than sales (calendar year, i.e., January 1 - January 1). Thus, it is possible to have anomalies in which life expectancy and sales are both below average, yet registration growth is average/above average and vice versa.

TABLE 2-5. TRUCK SHARE OF THE MOTOR VEHICLE FLEET

YEAR	TRUCK SALES/TOTAL SALES (%)	Δ%*	TRUCK REGISTRATIONS/TOTAL REGISTRATIONS (%)	Δ%*
1977	24.7	0.8	22.0	0.6
1976	23.9	1.6	21.4	0.8
1975	22.3	-1.0	20.6	0.5
1974	23.3	1.7	20.1	0.8
1973	21.6	2.2	19.3	0.7
1972	19.4	2.4	18.6	0.4
1971	17.0	-0.7	18.2	0.2
1970	17.7	0.6	18.0	0.6
1969	17.1		17.4	

* Δ% is the difference between successive years.

Source: Reference 3.

TABLE 2-6. TRUCK SALES, LIFE EXPECTANCY, AND REGISTRATIONS

TIME PERIOD	% GROWTH IN TRUCK REGISTRATIONS	LIFE EXPECTANCY** $\mathring{e}_o$ (YEARS)	YEAR	NEW TRUCK SALES/TRUCK REGISTRATIONS (%)
1976-77	6.3	13.1	1977	13.0
1975-76	7.0	14.9	1976	12.0
1974-75	6.4	15.6	1975	10.0
1973-74	8.9	14.3	1974	11.5
1972-73	8.3	14.2	1973	14.7
1971-72	7.1	13.5	1972	13.3
1970-71	4.4	13.8	1971	11.4
1969-70	6.6	13.9	1970	10.2
			1969	11.9
8-Year Avg.	6.9	14.2	9-Year Avg.	12.0

**Based on TSC analysis.

Source: Reference 3.

FIGURE 2-2. TRUCK SHARE OF THE MOTOR VEHICLE FLEET

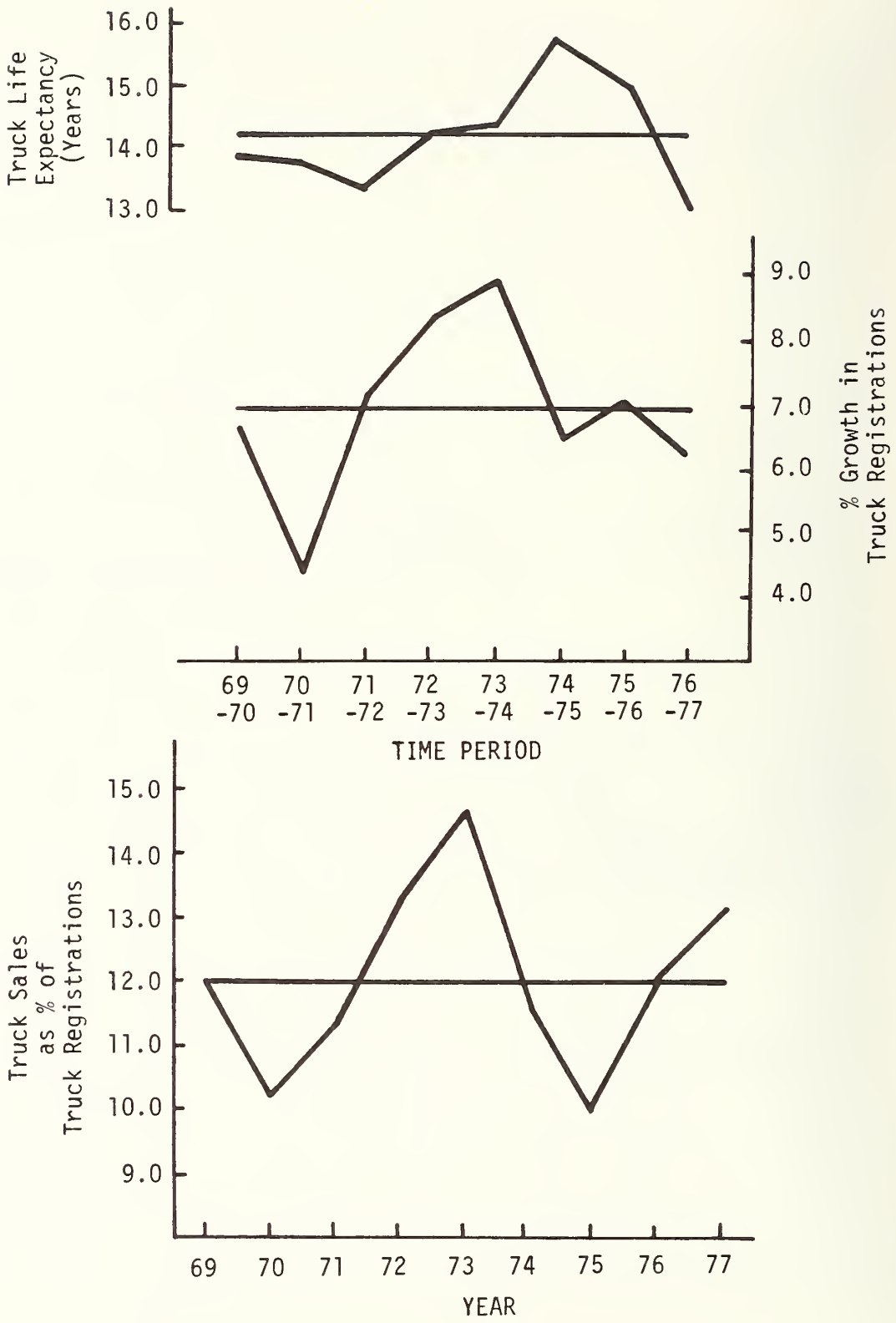


FIGURE 2-3. TRUCK SALES, LIFE EXPECTANCY, AND REGISTRATIONS

truck registration growth rate fluctuated greatly during the 1969-77 period. Truck life expectancy rose from 1969-1975 and declined rapidly between 1975 and 1977.

When the three elements of the puzzle are put together, an interesting picture emerges. Prior to the fuel shortage of 1973-1974, the truck market was relatively consistent. The trend in both sales contribution and life expectancy contribution to the size of the registered fleet was on the increase. Subsequent to 1974, the truck market showed extreme volatility. First, truck owners clung to their vehicles, while sales slowed. For 1974-1975, truck life expectancy reached an eight-year high, while 1975 sales dipped below 1972 levels. By 1977, sales were at an all-time high and life expectancy was at the lowest level of the eight-year period. The growth rate in truck registrations dipped during 1974-1975, was back up to average levels during 1975-1976, and dipped again during 1976-1977.

Hypotheses can be generated as to the source of the market volatility. Other data will be needed to test them. One can speculate that the fuel shortage created a wait-and-see attitude, that it hurt sales and increased vehicle life expectancy, and then was made up in 1977 with record sales. Or, one can surmise that the fuel shortage was one factor acting in conjunction with other economic pressures to defer sales to 1977. The rush to scrap-and-buy in 1977 may also have been in anticipation of future regulation of the truck manufacturing industry.

Table 2-7 and Figure 2-4 present the analagous picture for automobiles. The growth rate of car registrations vis-a-vis truck registrations is low. The car growth rate trend was generally upwards until the fuel shortage of 1973-1974. Subsequent to 1973-1974, it declined. After 1975, sales improved, and life expectancy declined. One could speculate that scrappage and sales increased in anticipation of perceived lower utility of the fuel economy regulations, except that the downsized 1977 GM vehicles were a market place success.[4] More likely, the reduction in growth rate of car registrations is due to market saturation, a

TABLE 2-7. AUTO SALES, LIFE EXPECTANCY, AND REGISTRATIONS

TIME PERIOD	% GROWTH IN CAR REGISTRATIONS	LIFE EXPECTANCY $\overset{o}{e}_o$ (YEARS)	YEAR	NEW CAR SALES/CAR REGISTRATIONS (%)
1976-77	2.5	9.8	1977	11.2
1975-76	3.3	10.3	1976	10.3
1974-75	4.0	10.9	1975	9.1
1973-74	3.9	9.8	1974	9.6
1972-73	3.1	9.1	1973	12.7
1971-72	2.8	9.4	1972	12.7
1970-71	2.7	9.8	1971	12.3
1969-70	2.1	8.9	1970	10.4
			1969	12.2
8-Year Avg.	3.1	9.8	9-Year Avg.	11.1

TABLE 2-8. AGE-GROUP-SPECIFIC AUTOMOBILES SURVIVAL

YEAR	ℓ_6/ℓ_0	ℓ_{11}/ℓ_6	ℓ_{15}/ℓ_{11}	$\overset{o}{e}_o$
1976-77	0.863	0.469	0.336	9.8
1975-76	0.883	0.508	0.365	10.3
1974-75	0.938	0.536	0.360	10.9
1973-74	0.904	0.431	0.262	9.8
1972-73	0.848	0.399	0.228	9.1
1971-72	0.880	0.391	0.235	9.4
1970-71	0.919	0.402	0.263	9.8
1969-70	0.851	0.329	0.233	8.9
8-Year Avg.	0.886	0.433	0.285	9.8

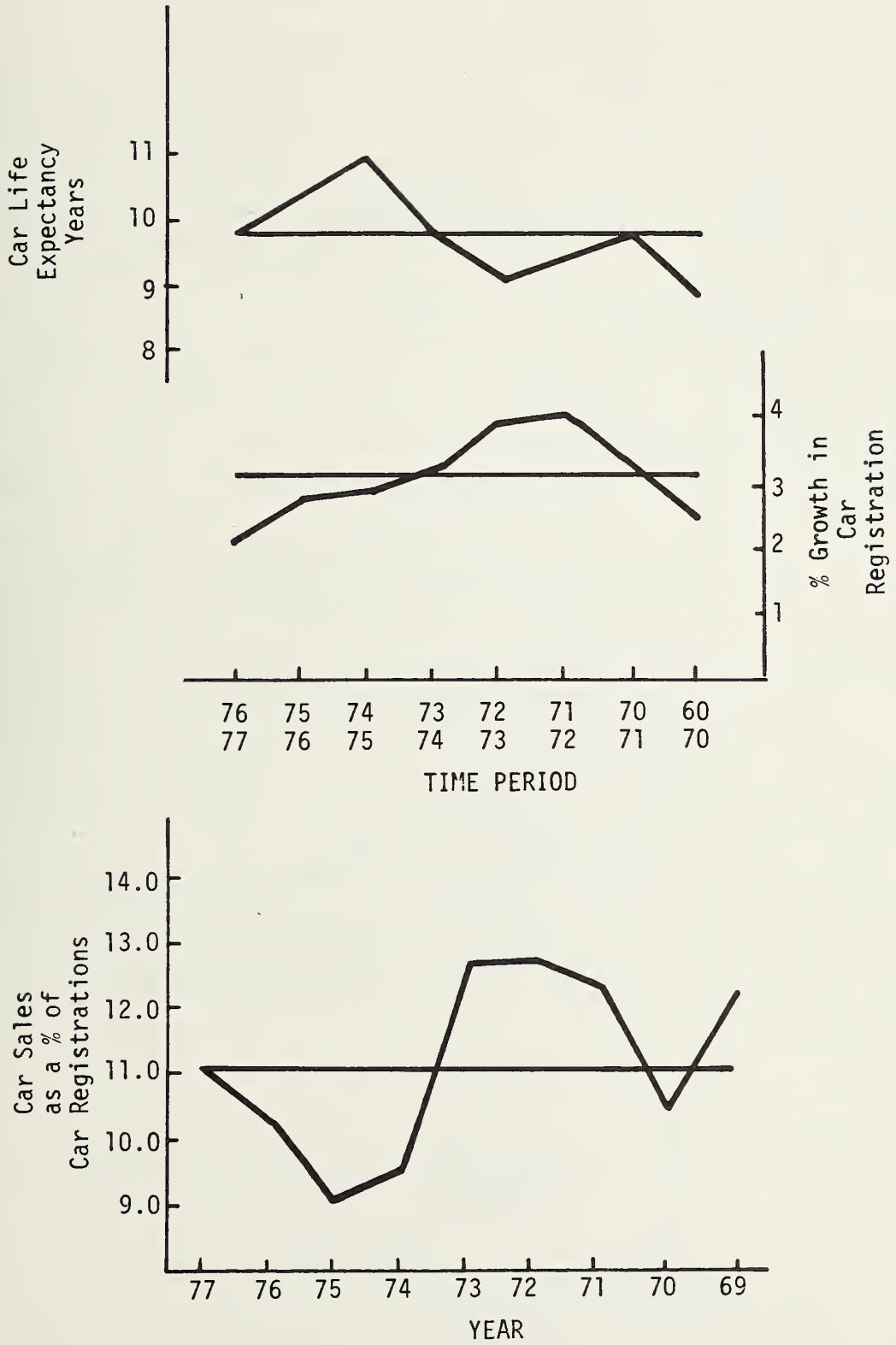


FIGURE 2-4. AUTO SALES, LIFE EXPECTANCY, AND REGISTRATIONS

decline in the needs and, therefore, the rate of increase of the number of cars per household, and the increase in truck sales.

There is a general upward trend, with periodic fluctuations, in auto life expectancy. This trend reflects consumer attempts to hedge against rising costs of auto ownership. Depreciation costs are reduced when the vehicle life increases. Longer life expectancy means a slower rate of fleet turnover to the more fuel efficient fleets.

d. Survivability by Age Group

($\overset{o}{e}_o$) is an overall measure of motor vehicle "health." An overall measure is required to flag areas of interest. However, the more disaggregate measures can also yield useful results. A disaggregate analysis, methodology, and results are discussed below.

Recall that ℓ_x is the size of the cohort of vehicles age x surviving out of 100,000 new vehicles. Thus, ℓ_x is the probability of survival to age x multiplied by 100,000. Dividing ℓ_x by 100,000 yields the probability that a given new vehicle will survive to age x. Dividing ℓ_x by $\ell_{x'}$ yields the probability of survival to age x given a vehicle age x' ($x' < x$). Tables 2-8 and 2-9 and Figures 2-5 and 2-6 break down the overall survival statistic ($\overset{o}{e}_o$) into into age-group-specific survival rates.

Re-examining the $\overset{o}{e}_o$ in Figure 2-5, it may be noted that $\overset{o}{e}_o$ has the same value (9.8) in 1970-71, 1973-74, and 1976-77. The distinct character of these three years emerges in the following excerpt from Table 2-8:

1976-77	0.863	0.469	0.336
1973-74	0.904	0.431	0.262
1970-71	0.919	0.402	0.263

The trend in survival for the middle and older age-group cars is up, and the trend among the newer cars is down. Overall survival $\overset{o}{e}_o$ descended to 8-year average levels during 1977, but consumers held on to their older cars at greater than 8-year average levels.

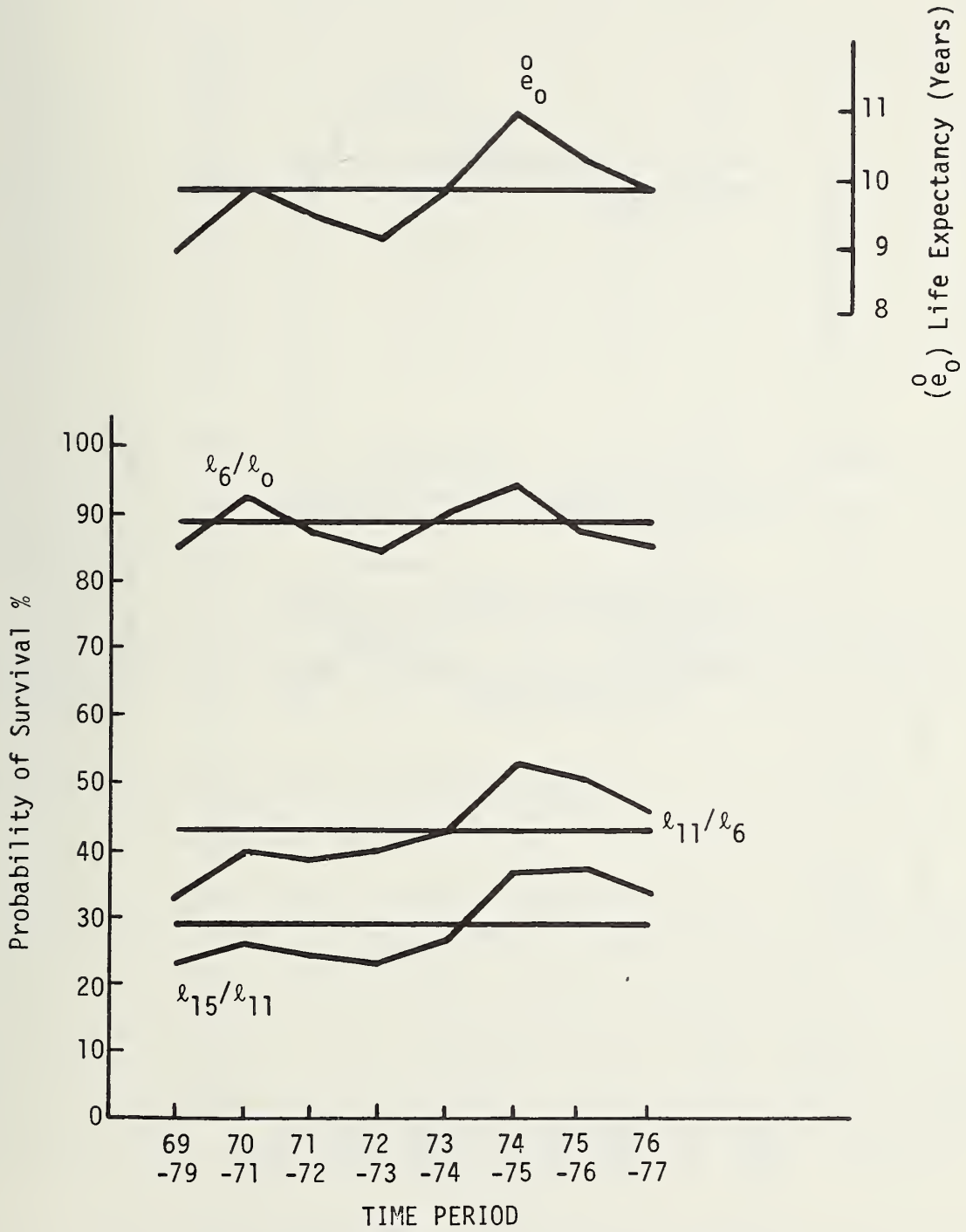


FIGURE 2-5. AGE-GROUP-SPECIFIC AUTOMOBILE SURVIVAL

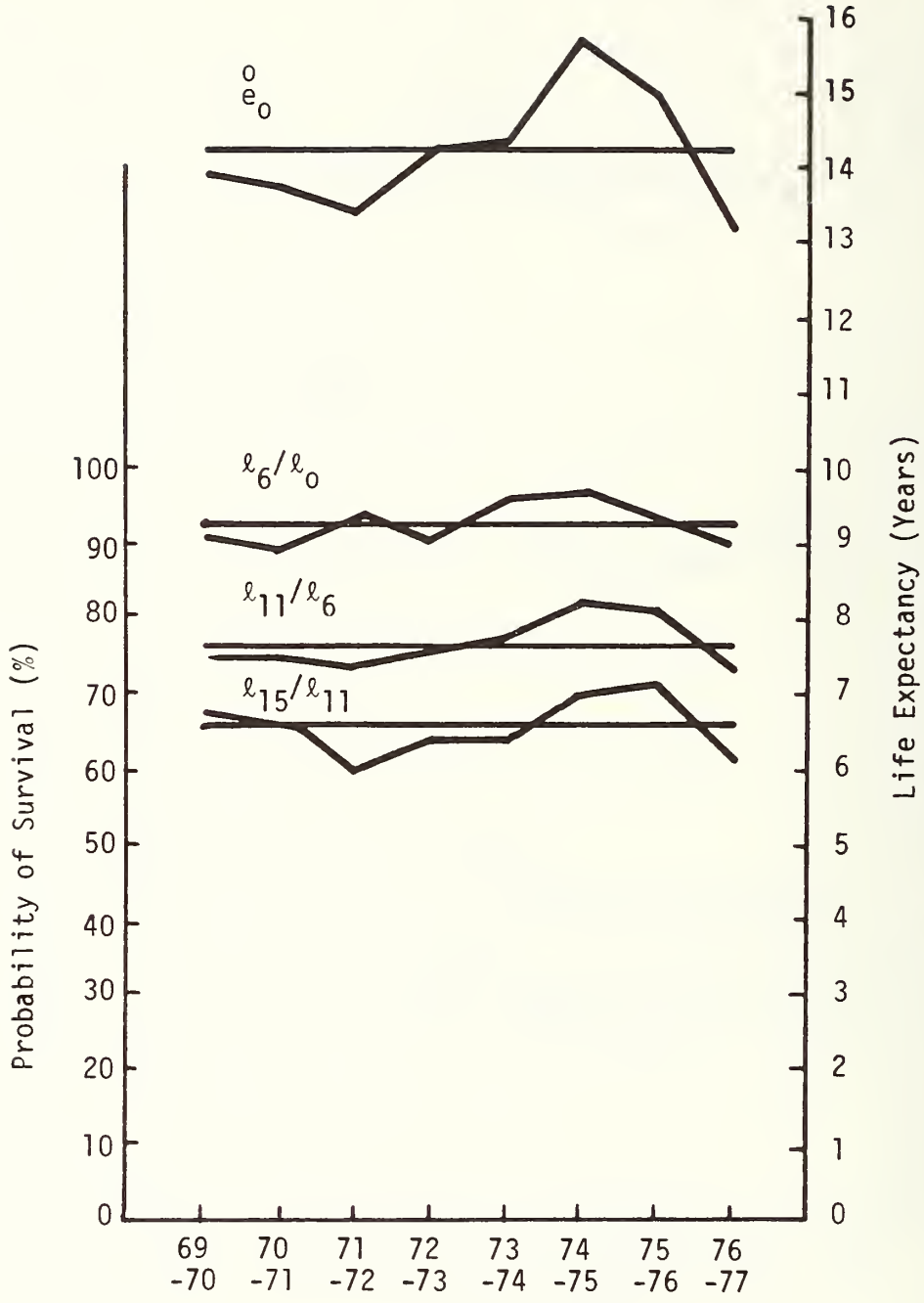


FIGURE 2-6. AGE-GROUP-SPECIFIC TRUCK SURVIVAL

TABLE 2-9. AGE-GROUP-SPECIFIC TRUCKS SURVIVAL

YEAR	ℓ_6/ℓ_0	ℓ_{11}/ℓ_6	ℓ_{15}/ℓ_{11}	$\overset{o}{e}_o$
1976-77	0.896	0.733	0.619	13.1
1975-76	0.927	0.805	0.709	14.9
1974-75	0.969	0.819	0.698	15.6
1973-74	0.957	0.766	0.644	14.3
1972-73	0.907	0.749	0.636	14.2
1971-72	0.944	0.736	0.601	13.5
1970-71	0.894	0.749	0.664	13.8
1969-70	0.908	0.753	0.671	13.9
8-Year Avg.	0.925	0.764	0.655	14.2

This upward trend in survival is more clearly discernible in the disaggregate curves.

Figure 2-6 reveals that the same is not true for trucks. Survival in 1977 declined below 8-year average levels among all age-groups.

2.3.4.3 Auto Fleet Life by Price Class

a. Approach

This section takes a preliminary look at the impact of automobile initial purchase price on life expectancy. To do this analysis, a "first-cut" approach was used to categorize the fleet by initial purchase price.* The domestic "makes" (Chevrolet, Buick, Mercury, etc.) were grouped by their 1977 sales-weighted price class (Table 2-10), using the 1978 Automotive News Market Data Book Issue price class and sales data.[5] More expensive

*A more appropriate classification was not possible due to data limitations. Pre-NVPP registration data useful in the analysis of price class impact on fleet life are restricted to make.

TABLE 2-10. MAKES BY SALES-WEIGHTED PRICE CLASS

MAKE	SALES-WEIGHTED PRICE CLASS	PRICE CLASS GROUP
American Motors	1.4	< 2
Plymouth	1.6	< 2
Dodge	1.9	< 2
Pontiac	1.9	< 2
Chevrolet	2.1	< 3
Ford	2.2	< 3
Mercury	2.3	< 3
Oldsmobile	2.6	< 3
Buick	2.8	< 3
Chrysler	3.3	3 +
Lincoln	5.0	3 +
Cadillac	5.0	3 +

Source: Reference 5.

1977 Make sales by price class and price class definitions are from 1978 Automotive News Market Data Book Issue.

TABLE 2-11. AUTO LIFE EXPECTANCY BY 1977 SALES-WEIGHTED DIVISION PRICE CLASS

YEAR	PRICE CLASS <2	PRICE CLASS <3	PRICE CLASS 3+	IMPORTS	ALL CARS
1976-77	10.0	9.8	10.2	10.8*	9.8
1975-76	10.2	10.2	10.8	10.9	10.3
1974-75	10.9	10.9	11.6	11.7	10.9
1973-74	9.7	9.6	10.2	11.7	9.8
1972-73	9.1	9.2	9.7	9.1	9.1
1971-72	9.3	9.5	9.8	9.0	9.4
1970-71	N.A.	9.6	10.6	10.8	9.8
1969-70	8.6	8.9	9.6	9.4	8.9

Note: *Excludes California due to possible data anomalies.

vehicles are given a higher number price class. Fleet life expectancy was computed for each make. The average life expectancy of all the divisions in each price class group was then computed. This "average" was used to represent the fleet life expectancy of the autos in each of the price class groups. The 1977 price class grouping of divisions was assumed to remain constant throughout the period 1969-1977. Fleet life expectancy for the various price class groups was computed similarly year-by-year for the period 1969-1977 (see Table 2-11). Fleet life comparisons were made (1) among the price class groups (see Figure 2-7), and (2) vis-a-vis the imports and all cars (see Figure 2-8).

b. Results

Prior to the 1973-1974 energy crisis, "the higher the price class group, the longer the life expectancy" was the rule (see Figure 2-7). Vehicles with high initial purchase prices are found more desirable by consumers. One possible explanation is that expensive new vehicles may exceed the means of many. However, as used vehicles, they retain some status appeal. Hence, the vehicles are better maintained, and consequently have longer fleet life. This phenomenon occurred despite the fact that the higher priced cars are likely to be more complex, i.e., have additional equipment, making maintenance more difficult and expensive. An alternative hypothesis is that the expensive vehicles are larger, heavier, and less subject to wear and tear.

Subsequent to petroleum shortages, the highest price class group retained its fleet life edge. However, the group of divisions with 1977 sales-weighted average new-car purchase price class between two and three lost its fleet life edge to the group with 1977 sales-weighted average new-car purchase price class less than two. The reason for the shift in fleet life ranking among the price class groups has not been determined to date. The shift may be related to changes taking place in market segmentations among the price class groups. To test the impact of

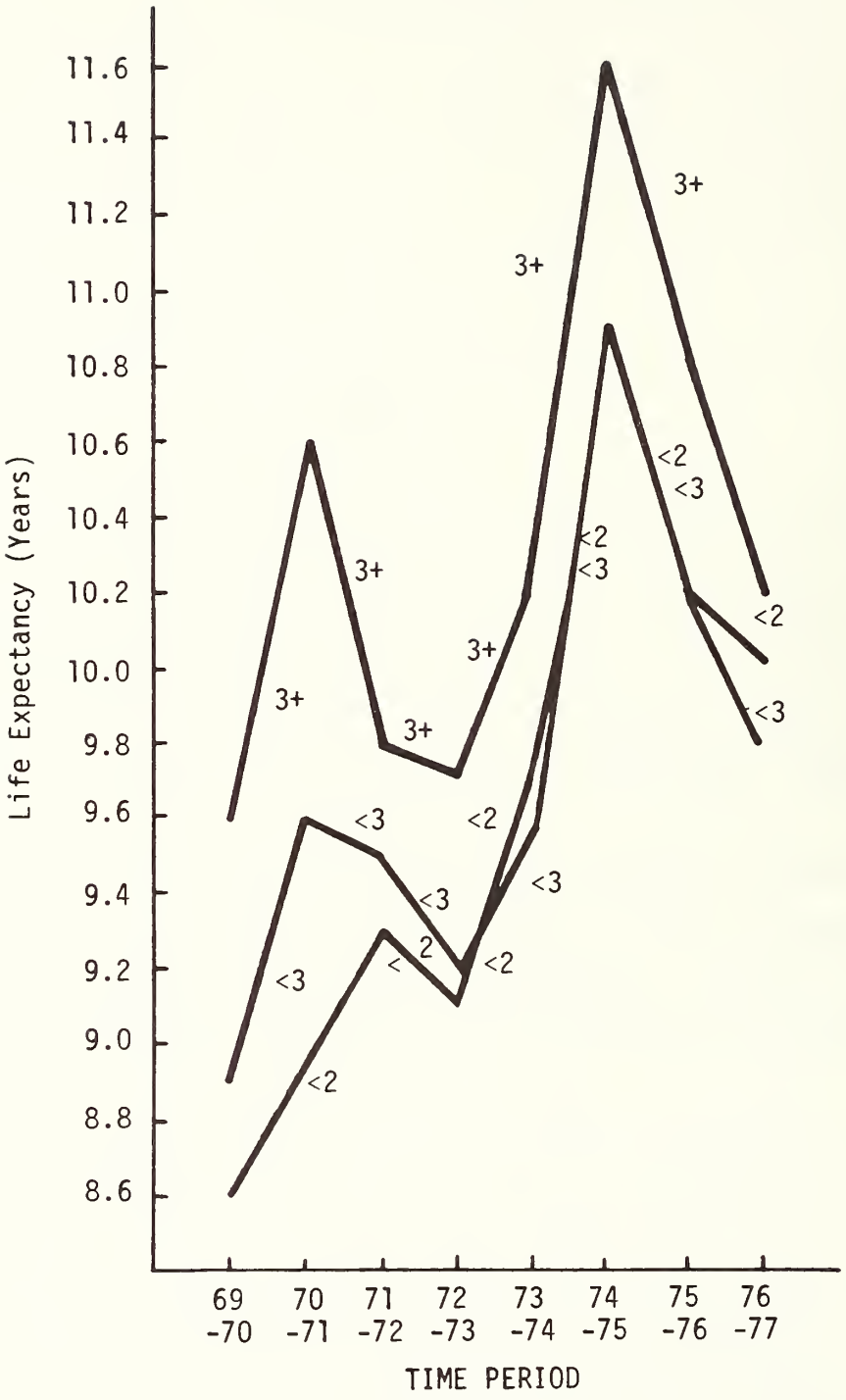


FIGURE 2-7. AUTO LIFE EXPECTANCY BY 1977 SALES-WEIGHTED DIVISION PRICE CLASS

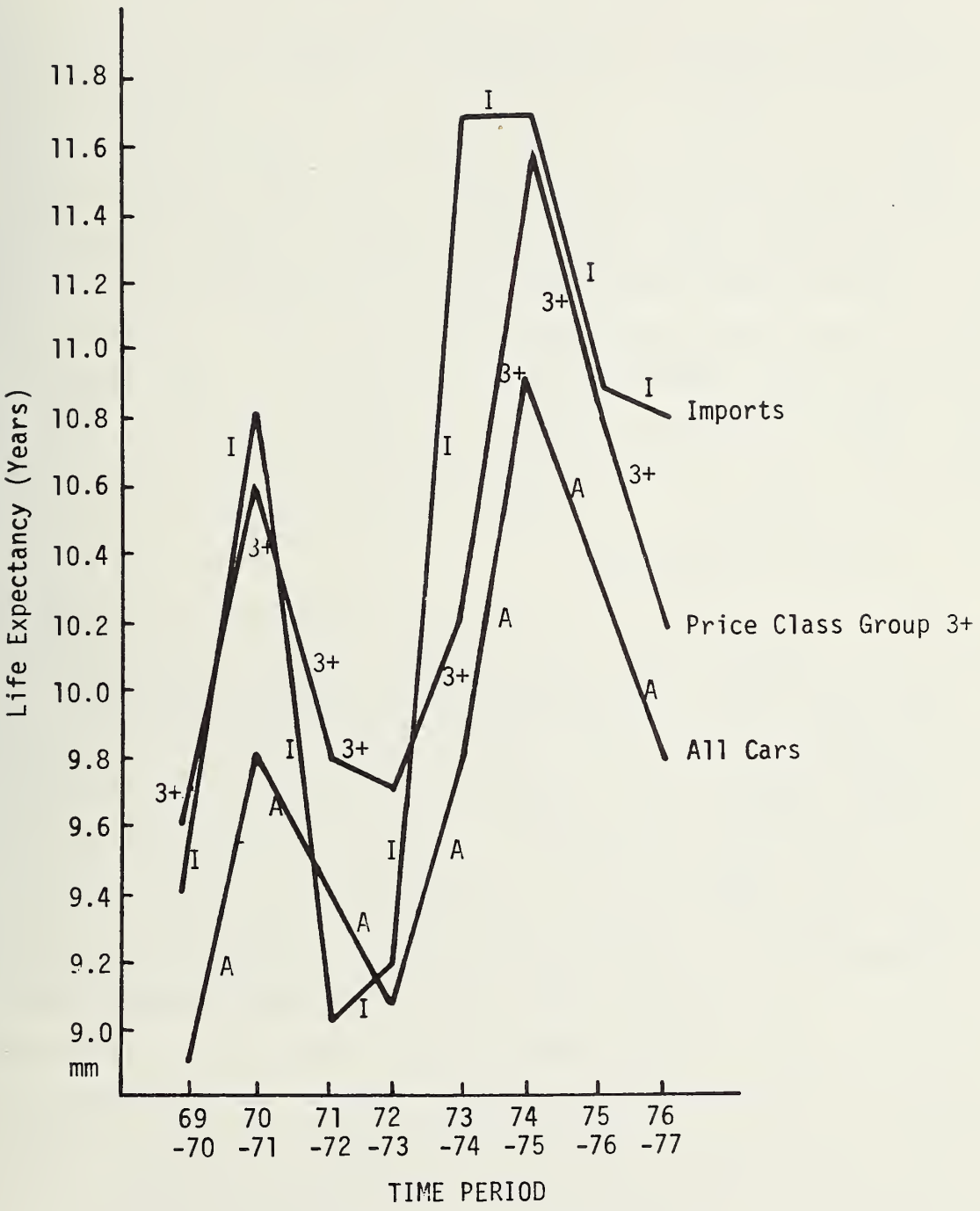


FIGURE 2-8. AUTO FLEET LIFE EXPECTANCY
IMPORTS VS. PRICE CLASS
GROUP 3+ VS. ALL CARS

market segmentation shifts, an analysis must be done to establish the relationship of size class* to life expectqancy.

Figure 2-8 shows that the imports have enjoyed superior fleet life expectancy. The imports do not share the "planned obsolescence" philosophy[4] of the major U.S. auto manufacturers. The imports are essentially of two types: inexpensive, small, relatively easy to maintain economy cars, and expensive, heavily engineered luxury cars. The major economy imports, Volkswagen, Toyota, Datsun, and Honda, represented between one-half and two-thirds of new import auto sales from 1962-1977.[1] Prior to 1970, Volkswagen alone accounted for more than half of all import auto sales. Thus, longevity in the fleet appears to be a trait of both autos "with style," considered highly desirable to the consumer public, and inexpensive, maintainable economy cars.

c. AFER Implications

New fuel economical vehicles that make greater use of electronics and require more "fine tuning" will be more difficult for the "do-it-yourselfer" to repair. Greater difficulty for the "do-it-yourselfer" does not automatically imply lower longevity in all market segments. Not all old vehicles are maintained by "do-it-yourselfers." Experience with the luxury imports shows that in some market segments heavily engineered vehicles have substantial longevity. If the fuel efficient vehicles are perceived as "desirable," they may have longevity. Potential impacts of the AFER program on consumers with respect to motor vehicle availability are costs of ownership and operation and vehicle utility. Longevity of fuel efficient vehicles implies availability of used vehicles of some sort. However, the market for "desirable" older vehicles and the market for older "economy" cars may be distinct market segments. Analysis of the used vehicle market is necessary

*Size class is an auto feature considered by the industry to be significant enough to "segment" the consumer market for its products.

to determine differences between old "desirable" cars and old "economy" cars with respect to cost of ownership, pattern of operation, and vehicle utility. The analysis should indicate whether a market segment would be denied access to private transport or otherwise negatively impacted by a decline in one type of used car or another.

Imports and luxury autos represent a minority of the auto fleet (new or used). What will happen to the majority of vehicles during the conversion to greater fuel efficiency? New fuel efficient vehicles, which are not perceived as "stylish" and are in addition "burdened" by more complex engineering, may negatively impact the consumer. Home maintenance and repair may become more difficult. Longevity may be reduced, in turn reducing availability of used autos. Lowering supply would increase the price of used vehicles as well as perhaps deny private transportation to a segment of the consumer market. Further analysis is required to substantiate these hypotheses.

2.3.4.4 Preliminary Results of NVPP Analysis - This section examines the influence of engine size (Table 2-12), body style (Table 2-13), and class size (Tables 2-14 and 2-15) on fleet life expectancy. Data employed are from the 1975 and 1976 NVPPs.

Fleet life variation within the auto fleet due to engine size grouping and body style is 10 percent or less, with the single exception of the "convertible." The convertible has a significantly lower fleet life expectancy.

Fleet life variation within the truck fleet shows significant correlation with body style. Note that: (1) the travel-all is essentially a passenger vehicle, (2) passenger vans and van buses have lower life expectancy than cargo-vans, and (3) cargo-vans are used as both commercial and personal-use vehicles. Thus, fleet life of trucks is more likely to be affected by commercial versus personal use than body style per se. Candidate reasons for this phenomenon are the superior maintenance practices of

TABLE 2-12. AUTO FLEET LIFE EXPECTANCY VIS-A-VIS ENGINE SIZE*

CUBIC INCH DISPLACEMENT	$\overset{o}{e}_o$
≤ 200	10.5
201-250	10.8
251-300	**
301-350	10.2
351-400	9.9
> 400	10.2

Notes: *Excludes Oklahoma.

**Not available due to data anomalies.

TABLE 2-13. MOTOR VEHICLE FLEET LIFE* VIS-A-VIS BODY STYLE**

	$\overset{o}{e}_o$
Trucks	
Pickups	16.8
Vans	12.0
Travel-alls	10.1
Autos	
Four-Door Sedans	11.0
Four-Door Hardtops	10.8
Two-Door Sedans	10.3
Passenger Vans and Van Buses	10.2
Coupes	10.1
Station Wagons***	10.0
Two-Door Hardtops	10.0
Convertibles	8.8

Notes:

* Excludes Oklahoma.

** Results are only for body styles with ten model years of consistent registration data in both the 1975 and 1976 NVPPs.

*** Excludes 1974 import station wagons due to data anomalies.

TABLE 2-14. AUTO FLEET LIFE VIS-A-VIS EPA SIZE CLASS: CHEVROLET 1976-1977

Subcompacts	9.4
Compacts	12.2
Intermediates	10.2
Full-sized	9.9

Notes: Subcompacts include Chevette, Vega, Camaro, Monza.

Compacts include Nova.

Intermediates include Malibu, Monte Carlo.

Full-sized include Impala, Caprice, Belair, Biscayne.

TABLE 2-15. ONE-YEAR SURVIVAL RATES OF CHEVROLETS BY SIZE CLASS

	SUBCOMPACT	COMPACT	INTERMEDIATE	FULL-SIZED
$_0S_1$	1.000	1.000	1.000	1.000
$_1S_2$	0.983	0.983	0.973	0.983
$_2S_3$	0.971	0.985	0.976	0.981
$_3S_4$	0.942	0.977	0.976	0.982
$_4S_5$	0.911	0.974	0.975	0.975
$_5S_6$	0.892	0.966	0.960	0.959
$_6S_7$	0.932	0.951	0.941	0.932
$_7S_8$	0.906	---	0.904	0.890
$_8S_9$	0.878	---	0.861	0.847
$_9S_{10}$	0.862	---	0.845	0.803
$_{10}S_{11}$	---	---	0.811	0.782

commercially used trucks, and comfort versus cost trade-off differences between commercial and personal use truck consumers.

The current phenomenon of expanding the personal use truck market segment can be expected to cause a decline in the fleet life expectancy of trucks.

A very preliminary analysis was done of the impact of size class on Chevrolet fleet life (see Table 2-13). The full-sized cars have a slightly poorer survival rate than the intermediates. The compacts are surviving very well during the first six years (see Table 2-14) which accounts for its very high fleet life. However, only seven data points were used in computing the fleet life of compact Chevrolets. Seven data points are insufficient for reliable results.

The subcompacts show an anomaly for "$_3S_4$" through "$_6S_7$" (see Table 2-15). Note the dip and subsequent rise. This anomaly makes the subcompact Chevrolet fleet life results unreliable. Future efforts to analyze the impact of size class on life expectancy should examine the entire domestic fleet to eliminate zero data cells and improve chances of avoiding anomalies.

2.4 FLEET COMPOSITION ANALYSIS

Fleet composition analysis examines the make-up of the motor vehicle fleet in a specific geographic area (for example, the U.S., state, county, group of states, or group of countries) with respect to one or more of the following parameters: age, make, model, series, engine size, size class, gross vehicle weight, or other feature of interest. Fleet composition analysis, together with fleet life analysis and analysis of sales patterns, presents a complete dynamic input-output type picture of the automotive fleet.

2.4.1 Significance of Fleet Composition Analysis to the AFER Program

A criterion of the AFER regulations is that they be economically feasible. Economic feasibility refers to manufacturer

solvency (sales and profitability), intra-industry competition, and consumer impacts.

Fleet composition analysis can be useful in understanding the markets for the products of the various manufacturers. Local changes in market share can be correlated with externalities (demograpic and economic factors) to yield insight into the competitive strengths and weaknesses of the manufacturers. AFER impacts can then be placed within the context of demographic and economic trends to assess intra-industry competition and product marketability.

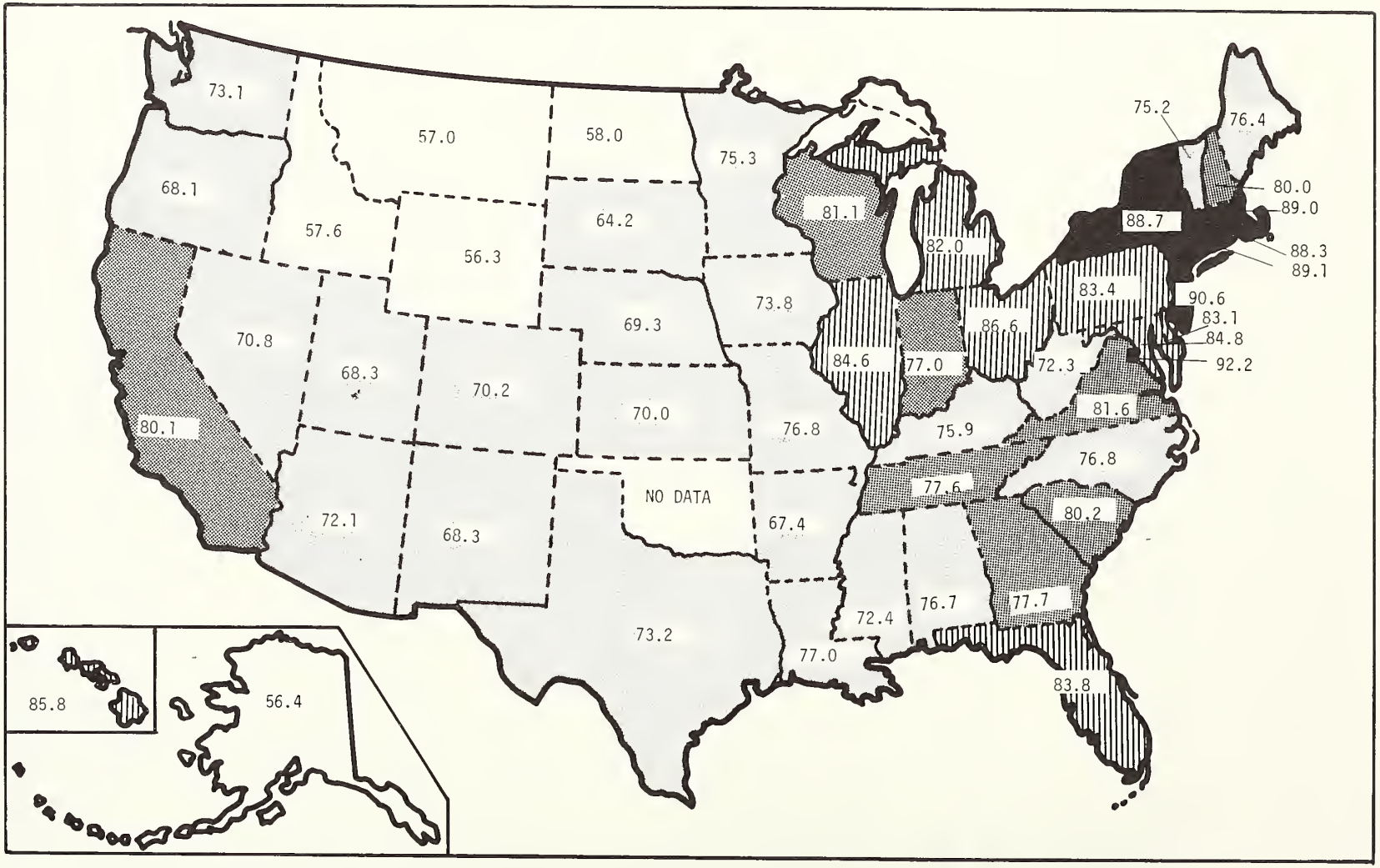
To understand the impact of AFER on different regional constituencies, changes in market share among the major U.S. corporations need to be tracked, both on a regional level and on a national level. Different regions within the U.S. have different requirements with respect to motor vehicles. This difference is expressed in varying demand levels of, for example, cars versus trucks, new cars versus old cars, Chrysler versus GM products, or large cars versus small cars.

The intent of the AFER program is to save fuel. Fuel use is dependent upon (1) VMT, (2) vehicle type and efficiency, and (3) the environment in which the vehicle is operated. Fleet composition analysis provides a critical input to the computation of fuel savings.

2.4.2 Preliminary Results of Fleet Composition Analysis

2.4.2.1 Proportion of Truck Versus Car Registrations - Fleet composition is not uniform throughout the United States. There is wide regional variation in the proportion of trucks in the motor vehicle fleet (Figure 2-9).

The West has a higher proportion of trucks in its fleet than any other region. However, census data[6] reveal that the percent of southern and western households owning trucks is very nearly the same. What then accounts for the difference in proportion of trucks in the fleet between the South and the West?



Note: National average is 79.6%

FIGURE 2-9. PASSENGER CARS AS A PERCENT OF TOTAL FLEET IN THE UNITED STATES ON JULY 1, 1976

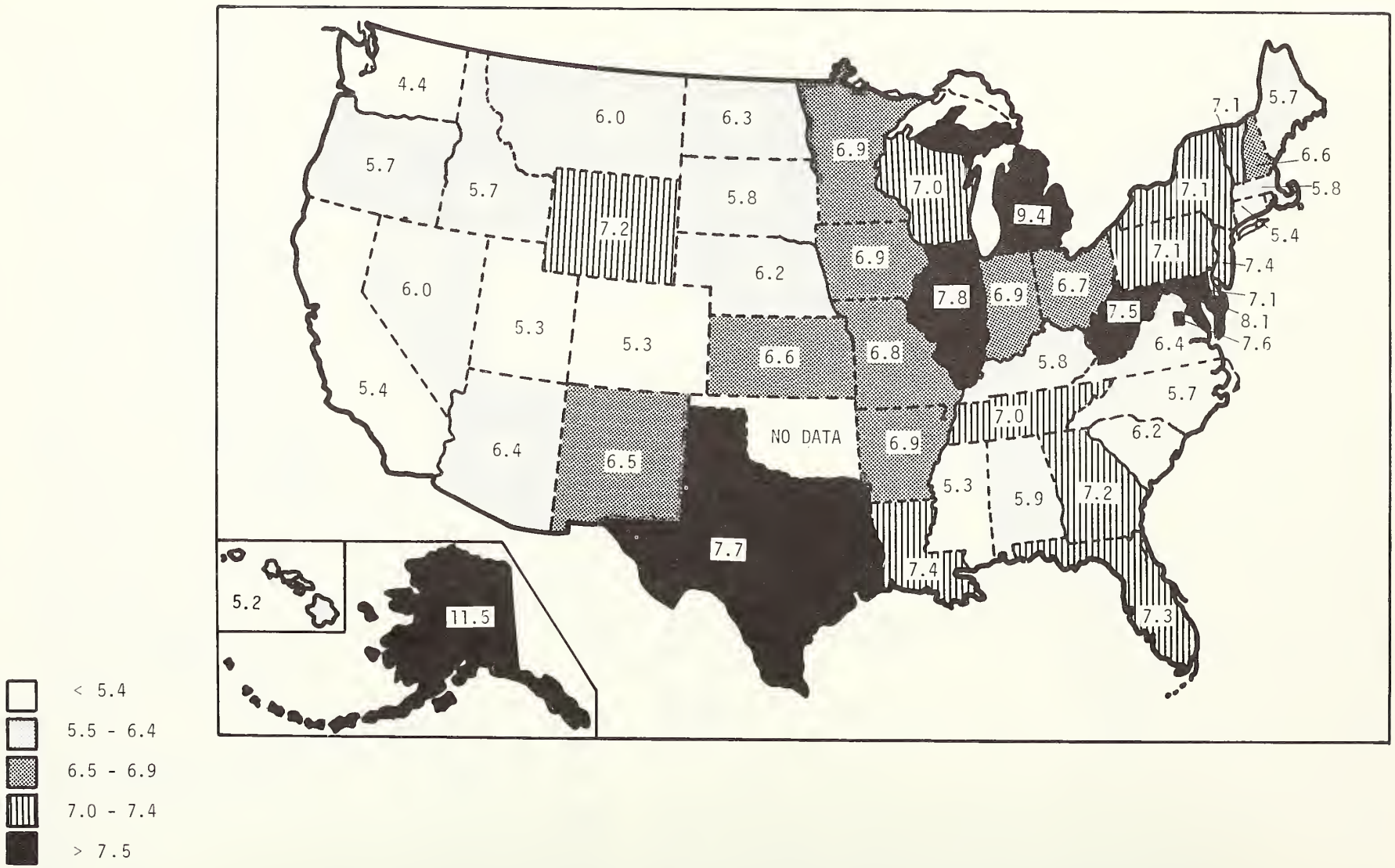
Western population centers and commodity transport are more dispersed. Less consolidation means a greater number of trips to deliver the same per-capita goods and service levels. Accessibility to the railroad alternative is also reduced in the West. Hence, the importance of truck commodity transport, and the proportion of trucks in the fleet, is greater in the West. The West is more agricultural than the East. Agricultural trucking is an unregulated industry. Lack of regulation encourages the trucking industry.

The implication of greater western reliance on the truck is that fuel economy regulation of the truck is likely to arouse the greatest resentment in the West. Regulations should consider the utility of the new fuel economical trucks so as to not excessively impact western economy and life style.

The West's population is growing relatively rapidly. Hence, one would expect, and the expectations could be confirmed, that there would be growth in the truck market relative to the auto market. Note that this is a preliminary finding and requires more detailed analysis to confirm.

2.4.2.2 New Vehicles Versus Old Vehicles - In 1976 a high proportion of new vehicles was found in the Midwest, Northeast, and South. The West has a relatively older fleet (Figure 2-10). The West has experienced a relatively fast population growth (Figure 2-11). Therefore, some of the trend toward increased automobile fleet life may be related to demographic trends.

Regional variation in the proportion of new cars in the fleet is significant to an analysis of AFER impacts on product marketability, intra-industry competition, and consumers of used vehicles. The geographical distribution of proportionate sales is a basis for analysis of industry marketing approach; i.e., are dealerships located and advertising/marketing targeted appropriately? Manufacturers can be compared to gain greater insight into their relative competitive strengths and weaknesses. Local demography/economy may be analyzed to understand the relationship



Note: National Average is 6.7%

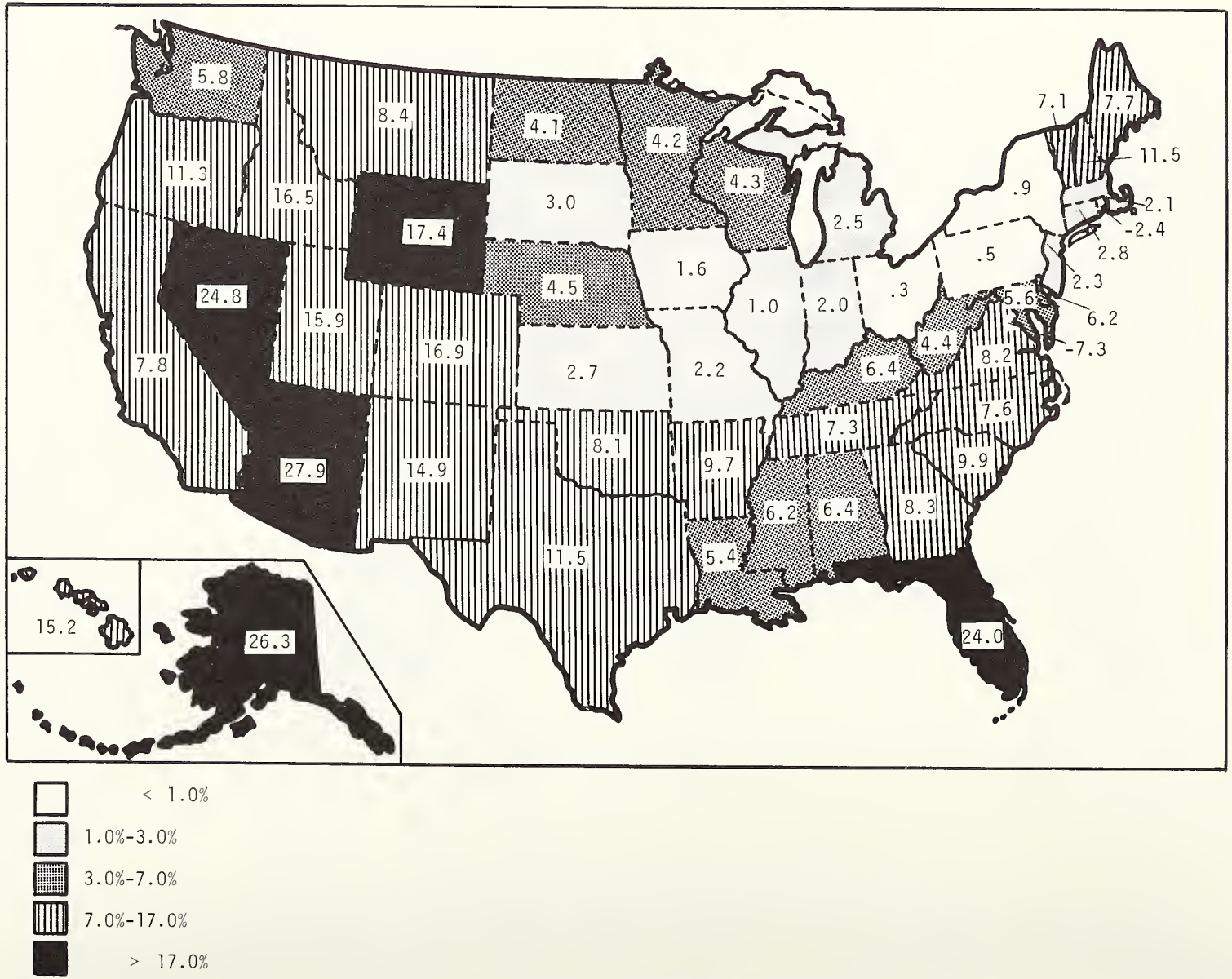
FIGURE 2-10. 1976 VEHICLES IN THE UNITED STATES ON JULY 1, 1976 AS PERCENT OF TOTAL FLEET

between new vehicle sales and demographic/economic factors. Current demographic/economic trends may then be studied to understand the direction in which the market is moving. With the above as background, the impact of AFER can then be examined.

From the consumer viewpoint, proportion of new cars in the fleet is an indication of the degree of consumer dependence on the used car market for mobility in support of current lifestyle. Thus, it is a measure of sensitivity to AFER regulation changing fleet life and/or cost of (used) auto ownership and operation.

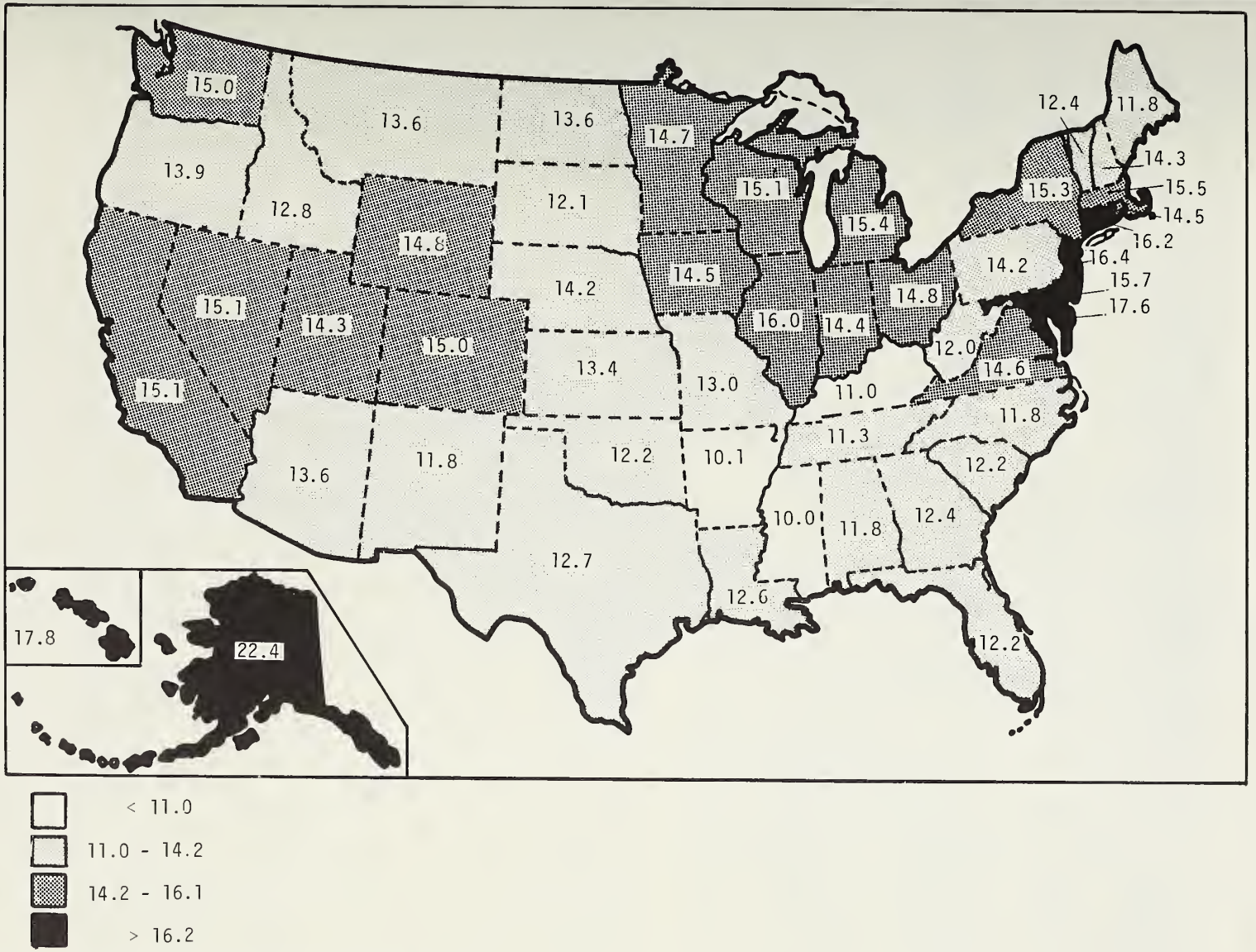
Generally, the East and Midwest have a higher proportion of new cars in the fleet than the West (Figure 2-10). The sources of this variation are complex, and in all likelihood cannot be attributed to any single factor. The West experienced considerable population growth during 1970-1976 (Figure 2-11). Some of this growth is attributable to net in-migration. One might surmise that a family moving to an area would experience some financial hardship and might temporarily postpone expenditures on a durable such as a new car. One should note, however, that Alaska and Florida have a very high growth rate and have a high proportion of new cars in their fleets. One would expect that median income is positively correlated to proportion of new vehicles in the fleet (Figure 2-12). Among the numerous exceptions are Connecticut (high income, low proportion of new cars) and Texas (low income, high proportion of new cars in fleet).

Should the AFER program negatively impact fleet life, the West, more highly dependent on its old cars, would be the hardest hit of the geographic regions.



Note: National Average is 5.6%

FIGURE 2-11. PERCENT CHANGE IN POPULATION IN THE UNITED STATES FROM 1970 TO 1976



Note: National Average is 14.2

FIGURE 2-12. MEDIAN FAMILY PER CAPITA INCOME IN THE UNITED STATES IN 1975 ($1000s)

2.5 REFERENCES FOR SECTION 2

1. Ward's Automotive Yearbooks, 1964 - 1978

2. Wharton EFA, Inc., An Analysis of the Automobile Market: Modeling the Long-Run Determinants of the Demand for Automobiles, Final Report, U.S. Dept. of Transportation, Transportation Systems Center, Report No. DOT-TSC-NHTSA-79-49.I, December 1979, Volume I.

3. Motor Vehicle Manufacturers Association, Facts and Figures '78, pp. 18, 34, 35.

4. Gilbert R. Green and Co., Inc., Automotive Marketing Methods and Practices, U.S. Department of Transportation, Transportation Systems Center, Report No. TSC 613-0060, July 1977.

5. 1978 Automotive News Market Data Book Issue, April 26, 1978.

6. U.S. Bureau of the Census, Annual Housing Survey, 1976, United States and Regions.

APPENDIX 2A

COMPUTING EXPECTED LIFE

Expected life of newborn infants during a given base year is the sum of the probabilities of survival from birth to age x for all x = 1, 2, 3, ... The probability of survival from birth to age x for newborns during a given base year is computed as the product of the one-year survival rates of 0-year olds, one-year olds, two-year olds, ... x-2 year olds, and x-1 year olds. To obtain the one year survival rate of an x-year old, the number of x + 1 year olds at the end of the base year is divided by the number of x-year olds at the beginning of the base year.

To apply the expected life concept to automotive fleet data, it is necessary to have a methodology for estimating the one-year survival rates for vehicles 15-years old and older. Model year is not specified for the significant number of vehicles older than 15 years in the data base.

The method employed was to fit a least square error curve to the one-year survival rate of vehicles age 0 to 14. The curve was of the form:

$$y_t = e - at^2$$

where:

y_t = one-year survival rate of a t-year old vehicle

e = the natural logarithmic base

a = a parameter to be estimated by least squares fit.

The estimated parameters were then used to estimate one-year survival rates for vehicles 15 to 25 years old. No estimates were made for vehicles older than 25 years old, under the premise that an insignificantly small number of such vehicles remain on the road.

3. BUSINESS CAR BUYING PATTERNS*

3.1 INTRODUCTION

The primary focus of this section is to outline the car buying patterns of the business sector. Of particular interest is the effect that innovations spurred by the federally mandated fuel economy regulations have had on the car buying patterns of the business car market. The body of this section is divided into two general parts. The first part (Section 3.3) deals with business car trends before the fuel economy regulations resulted in the downsizing of the General Motors (GM) standard models for the 1977 model year. The second portion (Section 3.4) deals with the change in business car trends that occurred as a result of the introduction of the smaller GM full-sizes in the 1977 model year and the smaller Ford and Chrysler full-sizes in the 1979 model year. The conclusions drawn from these results are presented in the final portion (Section 3.5).

3.2 MAJOR FINDINGS

- The only business car pattern affected by the introduction of the downsized full-sizes was the size composition of business fleets. The pre-1976 pattern of the full-sized share decline of fleet cars was reversed when the downsized full-size was introduced in the 1977 model year. Between 1970 and 1976, the percentage of fleet car purchases that were full-sized models declined from a high of 97 percent to 46 percent. Data on the new car composition of fleets for 1976 and 1977 indicate that although the total full-sized share increased from 24 percent in 1976 to 29 percent in 1977, the gain was due to increases by the GM full-sizes during 1977. Their share had in-

*This section covers business car buying patterns between 1970 and 1978. The primary research for this section was performed in January, 1979.

creased from 13 percent of the business fleet car purchases in 1976 to 18 percent by 1977. The non-downsized share continued its pre-1976 decline from 12 percent in 1976 to 11 percent in 1977.

- Additional data on new business car orders for 1979 indicate that the trend of share gains by the downsized full-sizes has continued. Ford, Chrysler, and GM all have downsized full-sizes for the 1979 model year, and the full-sized car share of the new business car orders has increased from 15 percent in 1978 to 21 percent in 1979.

- Exterior dimensions are important to the business car market. When cars in the early 1970's became longer, the business fleet market downgraded from the longer full-sized models to the shorter intermediate models. With the introduction of the downsized full-sizes in the 1977 model year, the business fleet industry began upgrading to the shorter full-sizes from the intermediates.

- There is only a limited market for compacts and sub-compacts in the business sector. The proportion of compact and sub-compact models in the business fleet market has remained relatively unchanged throughout the 1970's. Recently, there have been some increases in the proportion of luxury compacts in business fleets, but the trend has not existed long enough to establish a pattern of growth.

- In the business fleet car market, the resale value of fleet cars, which are kept only a few years, is an important cost item. Smaller vehicles of the intermediate length maximized the resale value of used fleet cars during the 1970's. The downsized full-sizes are expected to fare well in the used car market and return at least as much of the initial investment as intermediates.

3.3 BUSINESS CAR BUYING TRENDS THROUGH 1976

The federally mandated fuel economy standards led to the downsizing of the 1977 GM full-sized cars. In order to determine

the effect that the downsizing had on business car buying trends, an examination of the buying trends before downsizing must first be presented. Changes in business car buying trends identified only after downsizing can then be analyzed against the already established trends. The pre-downsizing business car trends examined are: (1) business car population and new car trends (Section 3.3.1), (2) business fleet car trends (Section 3.3.2), and (3) large business fleet size composition trends (Section 3.3.3). Post-downsizing trends are examined in Section 3.4.

3.3.1 Business Car Population and New Car Population Trends

The total business car population is composed of all cars that are acquired through leasing or buying for non-personal use. These cars are acquired by business firms, governments, taxi companies, police departments, utility companies, and organizations, in addition to professional and sales people for their non-personal use. An estimate, derived from Automotive Fleet[1] and Ward's Automotive Yearbook[2], of the size of the business auto population indicates that in 1976 at least 12 million cars, representing 11 percent of the total number of cars registered in the U.S., were for business use (see Table 3-1). Furthermore, the number of business cars increased each year since 1970, although its percentage of the total number of cars registered each year declined. Business cars increased 8 percent between 1970 and 1976, while the total car population increased 24 percent during the same period.

Business cars have not remained in business use for long periods of time (the norm is between 24 and 36 months), but they have remained in the registered fleet for their total expected vehicle life.[5] Therefore, the actual number of cars that have been in business use is larger than the number of cars currently in business use.

Although the business auto population was only 11 percent of the U.S. auto population in 1976, a Hertz Corporation estimate indicates that 47 percent of the new cars acquired in the U.S. in 1976 were for business use (see Table 3-2). Between 1970 and 1976,

TABLE 3-1. CARS IN BUSINESS USE (1970-1976)*
(Cars in Thousands)

	1970	1971	1972	1973	1974	1975	1976
Total Business Cars[a]	10,805	10,904	11,019	11,282	11,332	11,470	11,620
U.S. Car Registrations[b]	89,309	92,753	96,949	101,579	104,898	106,713	110,351
Percent (%) Business	11.6	11.7	11.4	11.1	10.8	10.8	10.5

* Includes corporate business cars, cars in small business fleets, cars in miscellaneous fleets, and individually leased cars.

Sources: a. Reference 1
b. Reference 2

TABLE 3-2. HERTZ CORPORATION ESTIMATES OF NEW BUSINESS CAR TRENDS (1970-1976)
(Cars in Thousands)

	1970	1971	1972	1973	1974	1975	1976
U.S. New Car Registrations[a]	8388	9831	10,488	11,351	8701	8262	9751
Business New Car Sales[b]	4889	4956	4990	4791	4688	4746	4557
Percent (%) Business	58.3	50.4	47.6	42.2	53.9	57.4	46.7

Sources: a. Reference 2 (estimates)
b. Reference 1 (Hertz estimates)

the trend in the number of new cars acquired for business use is not clear. There were increases in new business cars acquired between 1970 and 1972 that paralleled the increases in new car registrations occuring during the same period. After 1972, the business and total new car trends do not parallel each other, except during the 1973-1974 period when both decreased.

Another estimate of the size of the new business car population between 1970 and 1976 has been derived from the Survey of Current Business (SCB)[3,4] figures on the monies spent for new autos (see Table 3-3). The SCB-based data was obtained from records of new cars registered as business cars and is assumed to be a better representation of the business new car market than the Hertz figures in Table 3-2. The business new car patterns in the SCB-based data between 1970 and 1976 have been similar to the total new car patterns in the U.S.; when there were increases or declines in the number of new cars sold in the U.S., there were also increases or declines in the SCB-based estimates of new business cars bought. Business new car trends have reflected general new car buying trends in the U.S.

The SCB-based data also indicate that the percentage of new cars going to businesses varied between 1970 and 1976, but identify no general percentage trend. The range in the percent of new cars going to business from this data was between 25 percent and 31 percent. The largest share of new cars going to business use was in 1975 and 1976, after the 1973-1974 gasoline crisis. The smallest business car share was in 1972, before the gasoline shortage and in 1974, at the height of the shortage.

In summary, the size of the business car population has increased between 1970 and 1976, although the business share of the total number of cars registered in the U.S. has declined during the same period. There was no discernible trend in the number of new cars acquired by the business sector according to Hertz estimates. But, the Survey of Current Business (SCB) estimate of new business car trends indicated that business new car trends reflected general new car trends in the U.S. as a whole. When the total U.S. new

TABLE 3-3. SURVEY OF CURRENT BUSINESS ESTIMATE OF NEW BUSINESS CAR TRENDS (1970-1976)

	1970	1971	1972	1973	1974	1975	1976
U.S. New Car Sales[a] (Billions of Dollars)	30.1	38.8	43.0	47.1	39.9	43.2	55.2
Business New Car Sales[b] (Billions of Dollars)	8.0	10.3	10.9	13.1	12.2	13.2	16.0
Percent (%) Business	26.6	26.5	25.3	28.5	25.9	30.6	29.0
U.S. New Car Registrations[c] (Thousands of Cars)	8388	9831	10,488	11,351	8701	8262	9751
Number of New Business Cars* (Thousands of Cars)	2229	2610	2659	3157	2682	2525	2826

* Calculated from the % Business and U.S. New Car Registration data in the Table; example: (26.6)(8388)(K=.01) = 2229 for 1970.

Sources:
a. References 3 and 4, Consumer, business and government expenditures for new cars.
b. References 3 and 4, Business and government expenditures for new cars.
c. Reference 2 (estimates).

car purchases increased or decreased, so did new business car purchases. Also, the percentage of new cars going to business use varied between 25 percent and 31 percent between 1970 and 1976.

3.3.2 Business Fleet Car Trends

The majority of business use cars has been estimated to be in fleets of four or more vehicles operated by companies, organizations, and governments. In 1976, approximately 90 percent of the business cars were in fleets of four or more vehicles (see Table 3-4). Between 1970 and 1976, the percentage of business use cars that were in such fleets declined three points, but cars in fleets continued to dominate the business car market.

Fleet cars also grew between 1970 and 1976. The number of cars in fleets increased 4.1 percent, from approximately 10.0 million units in 1970 to 10.4 million units in 1976. The total number of business cars during the same period grew 7.5 percent, from 10.8 million units to 11.6 million units (see Table 3-4). Thus, although the size of the fleet car population increased between 1970 and 1976, it did not increase as fast as the total business car population.

When categories within the fleet population were examined, large corporate fleets (business firms with twenty-five or more cars), medium-sized corporate fleets (business firms with 10-24 cars), and non-corporate fleets (cars operated by government, taxi, utilities, police, rental, and driver schools) had all experienced gains in their number of cars, while small corporate fleets (business firms with 4-9 cars) had experienced declines in their number of cars between 1970 and 1976 (see Table 3-5). Large corporate fleets increased 26 percent from 1.9 million units to 2.3 million units between 1970 and 1976, medium-sized corporate fleets increased 8 percent from 652 thousand to 707 thousand cars between 1970 and 1976, and non-corporate fleets increased 18 percent from 1.7 million units to 2.0 million units during the same period. The number of cars in small corporate fleets declined 8 percent, from 5.8 million units to 5.3 million units.

TABLE 3-4. CARS IN FLEETS OF FOUR OR MORE (1970-1796)
(Cars in Thousands)

	1970	1971	1972	1973	1974	1975	1976
Total Business Cars	10,805	10,904	11,019	11,282	11,332	11,470	11,620
Cars in Fleets of 4+	9992	10,070	10,094	10,288	10,324	10,398	10,403
Percent (%) in Fleets	92.5	92.4	91.6	91.2	91.1	90.7	89.5

Source: Reference 1.

TABLE 3-5. CARS IN BUSINESS BY SIZE OF FLEET (1970-1976)
(Cars in Thousands)

	1970	1971	1972	1973	1974	1975	1976
Large Corporate Fleets (25+ cars)	1852	1878	1970	2189	2228	2234	2333
Medium Size Corporate Fleets (10-24 cars)	652	668	665	674	674	675	707
Small Corporate Fleets (4-9 cars)	5764	5754	5646	5538	5496	5514	5333
Non-Corporate Fleets*	1724	1770	1813	1887	1926	1975	2030
TOTAL	9992	10,070	10,094	10,288	10,324	10,398	10,403
% Large	18.5	18.6	19.5	21.3	21.6	21.5	22.4
% Medium	6.5	6.6	6.6	6.6	6.5	6.5	6.8
% Small	57.7	57.1	55.9	53.8	53.2	53.0	51.3
% Non-Corporate	17.3	17.6	18.0	18.3	18.7	19.0	19.5

* Includes government, utilities, taxi, daily rental, and driver school cars.

Source: Reference 1.

The fastest growing portion of the business fleet population has been the large corporate fleet market. In 1970, large corporate fleets comprised 19 percent of the fleet cars. By 1976, it contained 22 percent of the fleet cars (see Table 3-5).

Although the number of cars in medium-sized corporate fleets increased between 1970 and 1976, the proportion of fleet cars in medium-sized corporate fleets remained fairly constant between 1970 and 1975 before it began to gain somewhat between 1975 and 1976. In 1970 and 1975, the percentage of fleet cars in medium-sized fleets was 6.5 percent. Between 1975 and 1976, it had increased slightly to 6.8 percent.

The share of fleet cars in non-corporate fleets increased steadily between 1970 and 1976, from 17 percent to 20 percent. The share of fleet cars in small corporate fleets declined from 58 percent in 1970 to 51 percent in 1976. Thus, although the small corporate fleet market has declined, it has remained a large part of the business fleet market. But, the trend in new fleet car sales is expected to parallel the trend in the total number of new business car sales since all parts of the business sector are expected to have been influenced simultaneously and similarly by the same general economic factors. Thus, when there were increases in new business car sales, there should have been increases in fleet car sales. The data presented in Table 3-6, comparing new car trends in the total business market (SCB-based data) and in fleets that buy ten or more new cars each year, indicate that both had similar patterns of new car acquisitions between 1970 and 1976. For all years, except the 1971-1972 period, the gains or losses in new cars for both the total business and the large fleet markets were the same.

In summary, the business fleet market dominated the business car market between 1970 and 1976 with 90 percent of the business car population. The largest part of the business fleet market has been the small corporate fleet market, although its size has been declining continually. The fastest growing parts of the business fleet market between 1970 and 1976 have been the large corporate

TABLE 3-6. TOTAL NEW BUSINESS CAR AND NEW FLEET CAR TRENDS (1970-1976)
(Cars in Thousands)

	1970	1971	1972	1973	1974	1975	1976
Total New Business Cars[a]	2229	2610	2659	3157	2682	2525	2826
New Fleet Cars[b]	939	1048	1016	1229	1036	950	1104

Sources: a. SCB data from Table 3-3.
b. Reference 1. New fleet cars registered on all accounts buying ten or more units each year.

fleet market (+26 percent) and the non-corporate fleet market (+17 percent). The trend in new business fleet cars has paralleled the trend in total new business cars, i.e., it has reflected general economic patterns in the U.S.

3.3.3 Size Composition Trends of Large Corporate Fleets

In charting the trend in business car size changes, the finding (Section 3.3.2) that various parts of the business car market respond similarly to general economic factors is very important. Trend data since 1970 are not readily available on the size composition of the total business car population or of all the various parts of the business fleet market. Size composition trend data are only readily available for business cars in large corporate fleets (25 or more cars). It is assumed that the size composition trend of smaller corporate fleets is similar to the trend in large corporate fleets. Non-corporate fleets, because of their different use and disposal patterns, are not expected to be similar to corporate fleets in the type of cars that they have acquired.*

Data on the size composition of large corporate fleets between 1970 and 1976 are presented in Table 3-7. In 1970, the full-sized models dominated the large corporate fleets with 97 percent of the cars. But, between 1970 and 1976 the percentage of full-sized cars fell to 46 percent of the total. During the same period the intermediates jumped from 0 percent to 48 percent of the cars. Compact model shares increased slightly from 3 percent in 1970 to 6 percent in 1976.

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*Government, utility, taxi, police, and other non-corporate cars usually are held for long periods of time and disposed of in special auctions. Since they are not acquired with the expectation of selling them to consumers through used car showrooms, non-corporate cars are often stripped cars that are obtained at the lowest price available through bids. Since these cars do not have much impact on the U.S. car population beyond the period that they are in non-corporate fleet use, their size composition trends are not covered in the body of this report. See Appendix 3A for information on non-corporate fleet composition trends.

TABLE 3-7. COMPOSITION OF LARGE CORPORATE FLEETS BY PERCENT (1976-1976)

Year	Full-Sizes	Intermediates	Compacts
1976	46	48	6
1975	53	40	7
1974	62	33	5
1973	70	24	6
1972	76	19	5
1971	81	15	4
1970	97	-	3

Source: Reference 1.

The most dramatic changes occurred in the shares of full-sized and intermediate models. Even before the congressionally mandated fuel economy regulations resulted in the size reduction of full-sized cars, the business fleet market had begun the switch to smaller cars. Intermediates, for the first time, dominated the large fleet market in 1976.

The switch to smaller cars by the business fleet market undoubtedly indicates the desire for better gasoline efficiency by businesses, but other data suggest another explanation for the shifts may be the increased resale value of intermediates in the consumer market. Depreciation has remained the single most costly factor in fleet car costs for several years (see Table 3-8). When used business cars are sold directly to consumers, firms are more likely to get higher prices than if the cars are sold at auction. The data in Table 3-9 indicate that the proportion of used large corporate fleet cars sold to lessee employees doubled from 8 percent in 1972 to 16 percent in 1976. Although some of this increased employee sales is undoubtedly due to the slumping economy during the post-1973 period which caused many employees to purchase used rather than new cars, the gradual switch of fleet cars to the popular intermediate size is expected to have caused fleet cars to be more marketable to firm employees.

Other data on the decline of the disposal of used fleet cars through auctions have given additional support to the contention that fleet cars have increased their desirability in the consumer used car market. Cars that cannot be sold to consumers are usually disposed of through auctions which return proportionally less money than sales to dealers or employees. Between 1972 and 1976, the proportion of large corporate fleet cars sold at auction declined from 27 percent to 15 percent (see Table 3-9). During the same period, the proportion of fleet cars sold to car dealers increased from 51 percent to 62 percent. Fleet cars have become more desirable in the consumer market where they return more of their original selling price.

TABLE 3-8. FLEET CAR COSTS: PERCENT BY COMPONENT (1970-1976)

Year	Gasoline	Depreciation & Interest	Insurance	Maintenance	Tires	Other
1976	34.7	40.7	13.6	6.1	3.5	1.4
1974	33.2	41.3	12.6	6.0	5.5	1.4
1973	26.9	43.3	15.0	6.7	6.4	1.7
1972	24.8	48.0	11.9	6.9	6.5	1.9
1970	26.1	47.7	11.5	7.2	5.8	1.7

Source: Reference 5(F-24). All values reflect full-sized middle line series 4-door sedan, kept an average of 3 years and driven 60,000 miles.

TABLE 3-9. FLEET USED CAR DISPOSITION BY PERCENT IN CATEGORIES (1972-1976)

Year	Car Dealers	Auctions	Lessee Employees	Other
1976	62	15	16	7
1975	68	14	12	6
1974	63	16	9	12
1973	65	17	8	10
1972	51	27	8	14

Source: Reference 1, p. 32.

More current data on the type of accessories that businesses order on their cars indicate that business car accessories have become similar to car accessories, thus heightening their salability to the general public. Both new business cars and consumer cars for 1977 had similar proportions of air conditioning, automatic transmissions, power steering, radios, tinted glass, cruise control, and vinyl roofing (see Table 3-10). Consequently, used fleet cars have become more valuable; they have gravitated toward the type of cars that the general public desires -- loaded intermediate-sized cars.

Recently, federally mandated fuel economy measures led GM to downsize their 1977 full-sized models, i.e., 1976 Chevrolet Impala, to the size of their intermediates, i.e., 1976 Chevrolet Chevelle. In the next section, the effect that this model size change had on the business car population, the business fleet car population, and the business fleet car size composition trends of the 1970-1976 period are examined.

3.4 BUSINESS AND FLEET CAR TRENDS AFTER 1976

The data in Tables 3-11 and 3-12 indicate that the pre-1976 business car market size and new business car market size trends have continued unabated between 1976 and 1977. The business car population continued to grow between 1976 and 1977, from 11.6 million units to 11.8 million units. The share of business cars in the U.S. auto market continued its decline from 10.5 percent in 1976 to 10.3 percent in 1977 (see Table 3-11). The number of new cars sold in the U.S. increased from 9.8 million units in 1976 to 10.8 million units in 1977. Consistent with the pre-1976 patterns, the number of new business car purchases also followed the U.S. new car pattern. The number of new business car purchases increased from 2.8 million units in 1976 to 3.2 million units in 1977 (see Table 3-12).

The data in Table 3-13 indicate that the pre-1976 fleet car trends have continued. The business fleet market contained 88 percent of the total number of business cars in 1977, a decline from

TABLE 3-10. FIRMS OFFERING ACCESSORIES (%) COMPARED TO ACCESSORIES FOR NEW CARS (1977)

Accessory	Percentage of Firms Authorizing Accessories on New Cars[a]	Percentage of New Car Purchases With Accessory[b]
Air Conditioning	89	82
Automatic Transmission	88	95
Power Steering	91	92
Radio	90	91
Tinted Glass	82	87
Cruise Control	39	36
Vinyl Roof	38	48

Sources: a. Reference 5 (G-2).
b. Reference 2, p. 123.

TABLE 3-11. CARS IN BUSINESS USE (1976-1977)
(Cars in Thousands)

	1976	1977
Total Business Cars[a]	11,620	11,799
U.S. Car Registrations[b]	110,351	114,113
Percent (%) Business Cars	10.5	10.3

Sources: a. Reference 1.
b. Reference 2.

TABLE 3-12. NEW CARS IN BUSINESS USE (1976-1977)
(Cars in Thousands)

	1976	1977
New Business Cars[b]	2,826	3,198
New U.S. Car Registrations[a]	9,751	10,752
Percent (%) New Business Cars	29.0	29.7

Sources: a. Reference 2.
b. Estimates based on Survey of Current Business (1978) data.

TABLE 3-13. CARS IN FLEETS OF FOUR OR MORE (1976-1977)
(Cars in Thousands)

	1976	1977
Total Business Cars	11,620	11,799
Cars in Fleets of 4+	10,403	10,414
Percent (%) in Fleets	89.5	88.3

Source: Reference 1.

the 90 percent figure for 1976. The number of cars in fleets continued its pre-1976 pattern of increaisng in 1977. There were 10,403,000 cars in fleets in 1976 and 10,414,000 cars in fleets in 1977 (see Table 3-13). The data in Table 3-14 indicate that trends within the business fleet market have continued between 1976 and 1977. The size of both large corporate fleets and non-corporate fleets increased between 1976 and 1977 and their shares of the fleet market also increased. Large corporate fleets comprised 22.4 percent of the fleet market in 1976 and 22.6 percent of it in 1977. Non-corporate fleets' share of the fleet market increased from 19.5 percent in 1976 to 19.8 percent in 1977.

The pre-1976 pattern in the medium-sized corporate fleet market continued between 1976 and 1977. Between 1970 and 1976, the number of cars in medium-sized corporate fleets increased continually. Their share of the fleet car market, however, remained fairly constant between 1970 and 1975 and began to gain between 1975 and 1976. The number of cars in medium-sized corporate fleets increased from 707,000 units in 1976 to 716,000 units in 1977 (see Table 3-14). The share of the business fleet population attributable to cars in medium-sized corporate fleets continued its 1975-1976 pattern of gain as the share increased from 6.8 percent in 1976 to 6.9 percent in 1977.

The pre-1976 pattern of the small corporate fleet market also continued in 1977. The number of cars in small corporate fleets and their share of business fleet cars continued to decline. The number of cars in small corporate fleets declined from 5,333,000 units in 1976 to 5,282,000 units in 1977 (see Table 3-14). The small corporate fleet share of the fleet market continued to decline from 51.3 percent in 1976 to 50.7 percent in 1977, but small corporate fleets remained in the dominant position of the fleet car market.

In summary, the pre-1976 business car size and business fleet trends outlined in previous sections have continued between 1976 and 1977. Thus, the number of cars purchased by the business sector has not been affected by the introduction of the downsized

TABLE 3-14. CARS IN FLEETS BY SIZE OF FLEET (1976-1977)
(Cars in Thousands)

	1976	1977
Large Corporate Fleets (25+ cars)	2333	2351
Medium Sized Corporate Fleets (10-24 cars)	707	716
Small Corporate Fleets (4-9 cars)	5333	5282
Non-Corporate Fleets*	2030	2065
TOTAL	10,403	10,414
% Large Corporate Fleets	22.4	22.6
% Medium Sized Corporate Fleets	6.8	6.9
% Small Corporate Fleets	51.3	50.7
% Non-Corporate Fleets	19.5	19.8

* Includes government, utility, police, taxi, rental, and driver school use.

Source: Reference 1.

GM full-sizes during the 1977 model year; neither have the fleet car trends been affected by the introduction of the 1977 GM full-sizes. The patterns of small corporate fleet decline and large corporate fleet, medium-sized corporate fleet, and non-corporate fleet growth have continued, unaffected by the GM changes.

The introduction of the downsized full-sizes, however, did affect the trend in the size composition of business fleets. The data in Table 3-15 on the composition of new business fleet cars for the 1976 and 1977 model years indicate that the pre-1976 pattern of full-sized model share decline was reversed due to the presence of the 1977 GM full-sizes. The share of all full-sized cars increased from 24.4 percent of 1976 model year cars to 29 percent of 1977 model year cars (see Table 3-15). But, the gain was due to increases in the share of the GM full-sizes. The share of non-GM full-sized cars in the new fleet model year cars declined from 11.8 percent for 1976 to 10.6 percent for 1977, continuing the pre-1976 pattern. The share of GM full-sized cars, however, increased from 12.6 percent of the 1976 new fleet model year cars to 18.4 percent of the 1977 new fleet model year cars when the GM full-size was downsized. The downsizing of the GM full-sizes, therefore, caused them to be more acceptable to the business fleet market.

Data from the Runzheimer (1978)[7] survey of business car trends have provided additional insight into the fleet car changes that occurred between 1976 and 1977. Table 3-16 contains the Runzheimer survey results of the firms that planned changes in the composition of their new fleet cars anticipated for 1977. These data indicate that full-sized owners who planned changes switched almost equally to downsized GM full-sizes and intermediates for 1977.

The data in Table 3-17 summarize the anticipated changes for 1977. The share of GM full-sized models was expected to increase to 30 percent of the total, non-downsized full-sized shares were expected to decline from 53 percent to 6 percent, and intermediate shares were expected to remain unchanged. The downsized GM full-sizes of 1977, therefore, appear to be treated the same as

TABLE 3-15. COMPOSITION OF NEW FLEET CARS (1976 MY-1977MY)
(Size by % of Total)

	1976	1977
Full-Sized	11.8	10.6
GM Full-Sized	12.6	18.4
Intermediate	38.2	39.2
Compact	26.8	24.2
Sub-compact	8.3	4.9
Sport Compact	2.3	2.7
TOTAL	100.0	100.0

Sources: References 1 and 6.

TABLE 3-16. CHANGES IN FLEET COMPOSITION FOR 1977
(751 of 1318 Firms Responded)

FROM	TO	%
Full-Sized	GM Full-Sized	18
	Intermediate	24
	Compact	11
Intermediate	GM Full-Sized	9
	Full-Sized	4
	Compact	16
Compact	GM Full-Sized	3
	Full-Sized	2
	Intermediate	5
		100%

Source: Reference 7.

TABLE 3-17. SUMMARY OF CHANGES IN FLEET COMPOSITION FOR 1977 (751 of 1318 Firms Responded)

CAR SIZE	FROM	TO
GM Full-Sized	0%	30%
Full-Sized	53%	6%
Intermediate	29%	29%
Luxury Compact	6%	15%
Compact	7%	16%
Subcompact	5%	4%

Source: Reference 7.

intermediates have been treated by the fleet market.

Recent data from the National Association of Fleet Administrators (NAFA) indicate that the downsized full-sizes will continue to be treated like intermediates by the fleet market. For the 1979 model year, Ford and Chrysler have joined GM in downsizing their full-sizes. Fleets have responded by ordering proportionately more of the full-sized models for 1979 (see Table 3-18). The full-sized models' percentage of NAFA new car orders was 15 percent in 1978 and 23 percent in 1979. This increase in full-sized new car orders appears to have been at the expense of intermediates. NAFA intermediate shares of new car orders declined from 81 percent for 1978 to 71 percent for 1979. The downsized full-sizes, therefore, appear to be competing with the intermediates.

The growing acquisition of intermediates by the fleet market between 1970 and 1976, before the GM full-sized downsizing, indicates that this market had been moving faster than domestic manufacturers toward smaller, more fuel efficient autos. It is possible that the growth of intermediates and the decline of full-sizes in the fleet market assisted GM in deciding to reduce their full-sized cars as early as they did. Since the business market had not been buying full-sizes, the federally mandated fuel economy regulations may have been an incentive for the auto industry to discard autos that were in low demand. The business car market not only appears to have accepted smaller, more fuel efficient automobiles, but they may also have stimulated their development. However, the business car market is not expected to accept compacts and sub-compacts as readily as they accepted the downsized full-sizes.

The data on small car trends within the business fleet market have not been consistent. The most recent data on compact trends in the fleet market indicate that their share has increased since 1976 (see Tables 3-17 and 3-18). The data on sub-compact trends between 1976 and 1977 (see Table 3-17) indicate that the business fleet market is losing interest in them. Thus, there

TABLE 3-18. COMPOSITION OF NAFA* NEW CAR FLEET ORDERS (1978-1979) (By Percent)

	1978	1979
Compacts	4	6
Intermediates	81	71
Full-Sizes	15	23

* National Association of Fleet Administrators

Source: Reference 8.

has not been a clear trend of change that manufacturers can use to push compacts one way or another in the fleet market.

5 REFERENCES FOR SECTION 3 AND APPENDIX 3A

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9. General Services Administration, Federal Supply Service. Federal Motor Vehicle Fleet Report. Washington DC, March 1975.
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APPENDIX 3A

NON-CORPORATE FLEET COMPOSITION TRENDS

Non-corporate fleet cars, due to the nature of their use, tend to be disposed of at auctions rather than in used car showrooms. Many of them are prevented by law from entering the consumer used car market because of their abusive use. Non-corporate fleet cars, therefore, tend not to have any impact on the number of cars in the U.S. beyond the period for which they are operated by the non-corporate fleet market. For this reason, the car buying trends of non-corporate fleets are not considered in the body of this report.

The general size composition trend of non-corporate fleets is worth watching. An increasing proportion of business-use cars are in non-corporate fleets. The size trend of these cars, therefore, is important to note since they do comprise a sizable number of cars on the road. Accordingly, a brief note on the size composition trend of government, police, utility, and taxi fleet cars is covered below.

3A.1 GOVERNMENT FLEETS

One-third of the non-corporate fleet cars for 1978 were in government fleets (local, state, and federal fleets). Composition trend data are only available for cars in federal fleets, which accounted for 14 percent of the fleet cars used by governments.[9] Data on the size composition of federal fleets are presented in Table 3A-1. Between 1974 and 1977, the share of compact models in the federal fleet more than tripled, from 12 percent to 40 percent of the total. Full-sized and intermediate shares, respectively, declined from 55 percent to 37 percent and from 33 percent to 19 percent during the same period. Federal fleets had a different pattern of composition change than corporate fleets (see Section 3.3.3).

Federal fleets have gone more toward compact models than the

TABLE 3A-1. FEDERAL MOTOR VEHICLE INVENTORY BY TYPE (PERCENT) (1974, 1976, and 1977)

	Percent of Total in Categories		
	1974	1976	1977
Full-Sized	54.5	42.0	37.2
Intermediate	32.7	30.0	18.5
Compact	12.0	26.9	40.3
Subcompact	.8	1.1	4.0
TOTAL	100.0	100.0	100.0

Source: Reference 9, 10 and 11.

corporate fleet market which has all but avoided compact cars. This trend of federal fleets has produced a fleet that is more fuel efficient. Therefore, recent federal fuel economy measures that resulted in the downsizing of the full-sized models did not affect the trend of the federal fleet market which had been switching from both full-sized and intermediate models to compacts. The trend toward small cars within the federal fleets is expected to continue.

3A.2 POLICE FLEETS

The 292,000 units used by police fleets in 1978 represented 14 percent of the non-corporate fleet cars. Due to the nature of police work, which is concerned more with acceleration, speed, and braking than with fuel economy, one might expect that police fleets would not downsize their cars. However, smaller sized cars are easier to maneuver and have higher acceleration than larger full-sized cars with similar power plants. Consequently, a number of police departments have been downsizing their police car fleets and getting both speed and higher fuel economy.

The Chicago Police Department added 600 intermediate-sized Dodge Monacos to its fleet in 1977. The Michigan State Police Department downsized almost half of its fleet by obtaining 500 1977 intermediate Plymouth Furys. The North Carolina Highway Patrol is presently replacing 575 cruisers with the Plymouth Gran Fury. The California Highway Patrol is adding 1426 Monacos to its fleet and the Salt Lake City Police Department has downsized to the compact Volares for 1977.[12] This sample of police fleets located throughout the U.S. indicates that police fleets have been going to smaller intermediates and compacts. The downsizing of the full-sizes, with the maneuverability and acceleration of intermediates but with more interior space, is expected to have a positive effect on the police fleet market. Since many of the police fleets examined in the sample use Chrysler cars, the recent downsizing of the 1979 model year Chrysler full-sizes should result in an increased proportion of the downsized Chrysler full-sizes in police fleets.

3A.3 UTILITY AND TAXI FLEETS

Approximately 40 percent of the non-corporate fleet cars for 1978 were in utility and taxi fleets. Size composition trend data are not readily available for cars in utility companies (gas, electric, water, and similar companies) or in taxi companies. Both utility and taxi cars are primarily for passenger use and it is anticipated that they have gone to smaller models over the years to save fuel and purchase costs. Since utilities and taxi companies attempt to minimize initial purchase price and operating costs, they are not expected to upgrade to the smaller full-sizes from intermediates as the corporate fleet market has done. If these fleets had been purchasing non-downsized full-sizes it is anticipated that they would not switch from the newly downsized full-sizes because of their smaller exterior size. In all probability, they could maintain their size class and lower fuel costs with the downsized full-sizes which would lower operating costs. A more definitive statement about utility and taxi fleet car trends must await more rigorous analysis.

4. DOWNSIZING OF THE 1977 GM STANDARD CAR*

4.1 INTRODUCTION

This section analyzes the sales of the 1977 GM full-sized cars and their impact on early model buyers. General Motors began to downsize its car offerings with Model Year 1977 full-sized cars. This downizing - reduction in weight and exterior dimensions - was the first major design change by the industry to improve fuel consumption. General Motors downsized both its "B Body" and "C Body" full-sized cars. Specifically, the makes listed in Table 4-1 were downsized in the 1977 Model Year.

TABLE 4-1. GENERAL MOTORS' "B" AND "C" BODY CARS DOWNSIZED IN 1977

B Body	C Body
Chevrolet Impala Caprice	Cadillac deVille, Fleetwood
Pontiac Catalina	Pontiac Bonneville
Buick LeSabre	Buick Electra
Oldsmobile Delta 88	Oldsmobile 98

4.2 MAJOR FINDINGS

- GM's downsizing strategy for the 1977 model year full-sized car was a success in the market. It resulted in GM's increased industry share of the full-sized market.
- Downsizing resulted in improved fuel economy of the new GM full-sized cars.
- Positive aspects of downsizing:
  - Car buyers responded favorably to GM's new downsized 1977 full-sized cars,

*This section covers downsizing for a two model year time period. The primary research was performed during calendar years 1977-78.

- Car buyers' expectations of improved fuel economy were fulfilled,
- Improved fuel economy was an important factor in make selection.

o Negative aspects of downsizing:

- Car buyers perceived GM's new cars to lack style, roominess, comfort, smoothness of ride, and adequate length,
- Car buyers gave low ratings on transmission smoothness and reliable troublefree operation (factors which may only be related to new introduction rather than downsizing).

4.3 SALES OF DOWNSIZED GM FULL-SIZED CARS

4.3.1 General

GM downsizing was a success in the market place. Between Model Year 1976 and Model Year 1977, GM increased its sales and gained market share (see Table 4-2). General Motors sales of full-sized cars increased by about 30 percent, while total U.S. car sales increased by only 5 percent. Though both Ford and Chrysler increased their full-sized car sales, these increases were far more modest. Ford's full-sized car sales were up by 10 percent and Chrysler's by 2 percent.

GM's full-sized cars increased their share of all U.S. domestic car sales from 15.65 percent to 19.34 percent, or by 24 percent. Ford full-sized cars increased their share by 5 percent, while Chrysler full-sized cars decreased their share by 3 percent. In Model Year 1976, GM sold 62 percent of the "Big Three's" full-sized cars. After downsizing, in Model Year 1977, GM's share increased to 66 percent.

4.3.2 Early Model Buyer Attitudes and Behavior

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*Contract DOT-TSC-1391

TABLE 4-2. DOMESTIC FULL-SIZED CAR SALES FOR SALES YEARS 1976 AND 1977

Full-Sized Makes	10/1/75 - 9/30/76 Number	10/1/75 - 9/30/76 Market Share %	10/1/76 - 9/30/77 Number	10/1/76 - 9/30/77 Market Share %
General Motors				
Chevrolet	451,139	5.31	623,845	7.00
Pontiac	137,703	1.62	193,263	2.17
Oldsmobile	258,884	3.05	346,931	3.90
Buick	268,686	3.17	314,762	3.53
Cadillac	212,253	2.50	243,988	2.74
Total GM Full-Sized	1,328,665	15.65	1,722,789	19.34
Ford Motor Company				
Ford	389,464	4.59	379,093	4.26
Mercury	107,699	1.27	129,126	1.45
Lincoln Continental	119,669	1.41	168,874	1.89
Total Ford Full-Sized	616,832	7.27	677,093	7.60
Chrysler Corporation				
Plymouth	52,549	0.62	39,613	0.45
Dodge	39,047	0.46	39,353	0.44
Chrysler	97,295	1.14	113,279	1.27
Total Chrysler Full-Sized	188,891	2.22	192,245	2.16
Total Big Three Full-Sized Makers	2,134, 388	25.14	2,592,127	29.10
Other US Cars	6,354,603	74.86	6,314,309	70.90
Total US Cars	8,488,991	100.00	8,906,436	100.00

Source: Automotive News, various issues 1975-77.

was to assess the effects of size and weight reduction of General Motors full-sized cars on early model buyers.

The data source for this study was a proprietary data bank of 90,851 buyers of 1976 and 1977 model year cars previously assembled by Rogers National Research, Inc. from a national probability sample of all domestic and high volume import make buyers. The analysis focused on testing whether significant differences exist between the average attitudinal, behavioral, and demographic profiles of two a priori defined groups: buyers of downsized full-sized cars, and buyers of non-downsized full-sized cars. In doing this, four major comparison groups were specified as listed in Table 4-3. Fifty different variables describing the buyers of each make were analyzed. Described by category (see Table 4-4), the fifty variables are listed in Table 4-5.

Multivariate analysis narrowed the fifty variables down to those that significantly distinguished (at the 0.05 level of significance or better) between the appropriate downsized and not downsized groups. The analytical techniques employed were discriminant analysis within and across model year, multivariate significance testing of all predictor variables, and canonical mapping of appropriate make, manufacturer, segment, and model year comparison groups.

4.4 SUMMARY OF MULTIVARIATE ANALYSIS

4.4.1 1977 Chevrolet (Downsized) vs. 1977 Ford, 1977 Plymouth (Not Downsized)

Two group discriminant analyses reduced the 50 buyer variables to the 22 that distinguish 1977 Chevrolet buyers from 1977 Ford and Plymouth buyers. The average profiles on significant variables are shown in Table 4-6.

Similarly, two group discriminant analyses identified the seven (out of 50) variables that separate 1976 Chevrolet buyers from 1976 Ford and Plymouth buyers. This is shown in Table 4-7. All seven of the variables that distinguish the 1976 Chevrolet

TABLE 4-3. MAJOR COMPARISON GROUPS FOR TESTING

DOWNSIZED		NOT DOWNSIZED
1977 Chevrolet	vs.	1977 Ford/Plymouth
1977 Buick, Olds, Pontiac, Cadillac	vs.	1977 Mercury, Dodge, Chrysler, Lincoln Continental
1977 Chevrolet	vs.	1976 Chevrolet
1977 Buick, Olds, Pontiac, Cadillac	vs.	1976 Buick, Olds, Pontiac, Cadillac

TABLE 4-4. CATEGORIES OF SIGNIFICANT VARIABLES

	NUMBER OF VARIABLES
Descriptive aspects of new car purchased	8
New car evaluative ratings	18
Fuel economy ratings	8
Corporate image	4
Owner satisfaction and repurchase intentions	2
Demographic profile	10
	50

TABLE 4-5. PREDICTOR VARIABLES

Descriptive Aspects of New Car Purchased

- Has respondent owned this make before?
- Body style of new car
- Number of cylinders
- Transmission type
- Options purchased
- Purchase price
- Number of dealers visited
- Number of cars in household

New Car Evaluative Ratings

- Overall satisfaction
- Value for the money
- Condition when delivered
- Overall exterior styling
- Overall length
- Overall interior styling
- Overall interior roominess
- Overall interior comfort
- Overall useable trunk space
- Overall smoothness of ride
- Overall ease of parking
- Overall maneuverability in city traffic
- Pickup from standing start
- Pickup from passing at 45 MPH
- Ease of starting when cold
- Smoothness of transmission
- Reliable, trouble-free operation
- Quality of dealer service

Fuel Economy Ratings

- Overall operating economy
- Mileage (fuel economy)
- Miles per gallon (city and suburban driving)
- Percentage who find this more than expected (city and suburban driving)
- Miles per gallon (highway driving)
- Percentage who find this more than expected (highway driving)
- Influence of gas mileage on percentage buying smaller (rather than larger) car
- Influence of gas mileage on percentage buying this particular car

TABLE 4-5. PREDICTOR VARIABLES (CONTINUED)

Corporate Image

- Best looking cars
- Most comfortable riding cars
- Best engine performance
- Best resale value

Owner Satisfaction and Repurchase Intentions

- Percentage whose satisfaction with new car is better than expected
- Percentage who would buy this same make/series again

Demographic Profile

- Sex
- Marital status
- Position in household
- Age
- Formal education
- Number of children under 6 years
- Total family size
- Occupation
- Location of residence
- Income

TABLE 4-6. 1977 CHEVROLET FULL-SIZES VERSUS 1977 FORD/PLYMOUTH FULL-SIZED CARS, AVERAGE PROFILES ON SIGNIFICANT VARIABLES

DESCRIPTIVE ASPECTS	1977 Chevrolet	1977 Ford/Plymouth
Percentage whose car has 6 cylinders	14%	2%
Purchase Price -- net difference	$3,788	$4,119
EVALUATIVE RATINGS*		
Overall exterior styling	4.0	4.2
Usable trunk space	4.3	4.1
Ease of parking	4.3	3.9
Maneuverability in city traffic	4.4	4.1
Ease of starting when cold	4.0	3.8
Smoothness of transmission	3.5	3.8
FUEL ECONOMY		
Mileage (fuel economy) rating	3.2	2.9
MPG -- city and suburban	13.1	11.6
Percentage who find this better than expected	11%	6%
MPG -- Highway	16.2	14.6
Percentage who find this better than expected	11%	7%
Percentage where expected gas mileage influenced decision to buy smaller car	30%	6%
Percentage where expected gas mileage influenced decision to buy this particular car	41%	22%
CORPORATE IMAGE		
Percentage Who Believe GM Has:		
Best looking cars	64%	7%
Most comfortable riding cars	58%	7%
Best engine performance	60%	7%
Best resale value	67%	18%
DEMOGRAPHICS		
Percentage married	82%	80%
Formal education (in years)	12.4	12.0
Percentage whose occupation is professional/managerial	24%	17%

Discriminant function correctly classifies:

82% of 1977 Chevrolet Standard Buyers (376 out of 459)
93% of 1977 Ford/Plymouth Standard Buyers (336 out of 361)

*Five point rating scale: Excellent = 5
Very good = 4
Good = 3
Fair = 2
Poor = 1

TABLE 4-7. 1976 CHEVROLET FULL-SIZES VERSUS 1976 FORD/PLYMOUTH FULL-SIZED CARS, AVERAGE PROFILES ON SIGNIFICANT VARIABLES

DESCRIPTIVE ASPECTS	1976 Chevrolet	1976 Ford, 1976 Plymouth
Purchase price -- net difference	$3,467	$3,729
EVALUATIVE RATINGS*		
Ease of starting when cold	4.1	3.7
CORPORATE IMAGE		
Percentage Who Believe GM Has:		
Best looking cars	73%	9%
Most comfortable riding cars	66%	7%
Best engine performance	67%	7%
Best resale value	78%	18%
DEMOGRAPHICS		
Percentage married	85%	88%

*Five point rating scale: Excellent = 5
Very good = 4
Good = 3
Fair = 2
Poor = 1

buyers from the 1976 Ford/Plymouth buyers also discriminate between the 1977 Chevrolet buyers and the 1977 Ford/Plymouth buyers. Since they appear in both sets (before and after downsizing), it can be assumed that these seven significant variables are not major discriminants resulting from downsizing, although the magnitude of their differences is affected. (As such, the 1976 model year can be considered as a control group.)

After subtracting the discriminating variables that appeared in both model years from those that separated the 1977 Chevrolet buyers from the 1977 Ford and Plymouth buyers, the remaining significant variables can be assumed to be discriminants more directly related to downsizing or other changes that occurred between the 1976 to the 1977 model year.

Those variables unique to the 1977 model year are shown below. It is quite clear that attributes related to fuel economy are important discriminants distinguishing the 1977 Chevrolet buyers from the 1977 Ford and Plymouth buyers, with seven of the eight fuel economy variables measuring out as significant variables. Buyers of 1977 Chevrolet show:

a. FUEL ECONOMY

- o Higher percentage where expected gas mileage influenced decision to buy smaller car (30 percent for Chevrolet, 6 percent for Ford/Plymouth).
- o Higher percentage where expected gas mileage influenced decision to buy this particular car (41 percent for Chevrolet, 22 percent for Ford/Plymouth).
- o Better fuel economy rating.
- o Better mileage - city and suburban.
- o Higher percentage who found city and urban mileage better than expected.
- o Better highway mileage.
- o Higher percentage who found highway mileage better than expected.

b. EVALUATIVE RATINGS

Better ratings on:

- o Ease of parking.
- o Maneuverability in city traffic.
- o Usable trunk space.

Poorer ratings on:

- o Overall exterior styling.
- o Smoothness of transmission.

c. DESCRIPTIVE ASPECTS

- o Higher percentage with 6 cylinder engine.

d. DEMOGRAPHICS

- o More formal education.
- o Higher percentage whose occupation is professional/ managerial.

e. CORPORATE IMAGE

- o Dropped an average of 9 percentage points while those of Ford and Plymouth remained approximately constant.

4.4.2 1977 Buick, Oldsmobile, Pontiac, Cadillac (Downsized) vs. 1977 Mercury, Dodge, Chrysler, Lincoln Continental (Not Downsized).

Results of analyzing the downsized medium and high priced full-sizes turned out to be very similar to those of the low priced full-sizes. In the case of the medium and high price full-sizes, 12 of the 50 variables separated 1976 GM full-sizes from competitive full-sizes (see Table 4-8). All 12 of these significant variables also distinguished 1977 GM full-sizes from competitive full-sizes (see Table 4-9).

In addition, however, the following significant differences separate 1977 GM downsized full-sizes from competitive full-sizes that were not downsized. As was the case with the low priced

TABLE 4-8. 1976 GM MEDIUM AND HIGH PRICE FULL-SIZES VERSUS 1976 FORD AND CHRYSLER MEDIUM AND HIGH PRICE FULL-SIZES, AVERAGE PROFILES ON SIGNIFICANT VARIABLES

DESCRIPTIVE ASPECTS	1976 Medium and High Price Standard Size Manufactured by General Motors (1)	Ford Motor Company (2) Chrysler Corporation (3)
Percentage who have owned this make before	77%	68%
Percentage whose car is a 2-door model	40%	21%
Percentage whose car has vinyl top	82%	86%
EVALUATIVE RATINGS (4)		
Ease of starting when cold	4.0	3.6
Reliable, trouble-free operation	3.9	3.7
FUEL ECONOMY		
MPG -- highway	14.8	14.5
CORPORATE IMAGE		
Percentage Who Believe		
GM Has:		
Best Looking cars	72%	10%
Most comfortable riding cars	69%	4%
Best engine performance	63%	10%
Best resale value	72%	29%
DEMOGRAPHICS		
Age (in years)	52.1	53.4
Percentage who reside in metropolitan areas or big city suburbs	57%	42%

(1) Buick, Oldsmobile, Pontiac, Cadillac
(2) Mercury Marquis, Lincoln Continental
(3) Dodge, Chrysler Newport, Chrysler New Yorker
(4) Five point scale: Excellent = 5
Very good = 4
Good = 3
Fair = 2
Poor = 1

TABLE 4-9. 1977 GM MEDIUM AND HIGH PRICE FULL-SIZES VERSUS 1977 FORD AND CHRYSLER MEDIUM AND HIGH PRICE FULL-SIZES, AVERAGE PROFILES ON SIGNIFICANT VARIABLES

DESCRIPTIVE ASPECTS	1977 Medium and High Price Standard Size Manufactured by General Motors (1)	Ford Motor Company Chrysler Corporation (2) (3)
Percentage who have owned this make before	75%	63%
Percentage whose car is a 2-door model	33%	25%
Percentage whose car has 6 cylinders	4%	2%
Percentage whose car has vinyl top	84%	90%
EVALUATIVE RATINGS (4)		
Overall exterior styling	4.0	4.3
Overall interior roominess	3.9	4.2
Usable trunk space	4.1	3.8
Ease of parking	4.3	3.9
Maneuverability in city traffic	4.4	4.2
Ease of starting when cold	4.1	3.8
Reliable, trouble-free operation	3.1	2.5
FUEL ECONOMY		
Mileage (fuel economy) rating	3.3	2.9
MPG -- city and suburban	12.8	11.3
Percentage who find this better than expected	14%	5%
MPG -- highway	15.8	14.7
Percentage who find this better than expected	14%	7%
Percentage where expected gas mileage influenced decision to buy smaller car	17%	10%
CORPORATE IMAGE		
Percentage Who Believe GM Has:		
Best looking cars	62%	10%
Most comfortable riding cars	60%	7%
Best engine performance	60%	10%
Best resale value	69%	31%
DEMOGRAPHICS		
Percentage who are make head of household	74%	79%
Age (in years)	51.3	53.4
Formal education (in years)	13.2	12.5
Percentage whose occupation is professional/managerial	30%	26%
Percentage who reside in metropolitan areas or big city suburbs	58%	42%
Income	$28,674	$23,744

Discriminant function correctly classifies:
82% of 1977 Other GM Standard Buyers (884 out of 1082)
91% of 1977 Ford/Chrysler Standard Buyers (643 out of 708)

(1) Buick, Oldsmobile, Pontiac, Cadillac
(2) Mercury Marquis, Lincoln Continental
(3) Dodge, Chrysler Newport, Chrysler New Yorker
(4) Five point scale scale: Excellent = 5
Very good = 4
Good = 3
Fair = 2
Poor = 1

full-sizes, it is quite clear that attributes related to economy are important determinants distinguishing the 1977 Buick, Oldsmobile, Pontiac, and Cadillac buyers from the 1977 Mercury, Dodge, Chrysler, and Lincoln Continental buyers, with five of the eight fuel economy variables turning out to be significant variables. 1977 Buick, Oldsmobile, Pontiac, and Cadillac buyers show:

a. FUEL ECONOMY

- o Better fuel economy rating.
- o Better mileage - city and suburban.
- o Higher percentage who found city and suburban mileage better than expected.
- o Higher percentage who found highway mileage better than expected.
- o Higher percentage where expected gas mileage influenced decision to buy a smaller car (17 percent for GM, 10 percent for competitive full-sizes).

b. EVALUATIVE RATINGS

Better ratings on:

- o Ease of parking.
- o Maneuverability in city traffic.
- o Usable trunk space.

Poorer ratings on:

- o Overall exterior styling.
- o Overall interior roominess.

c. DESCRIPTIVE ASPECTS

- o Higher percentage with 6 cylinder engines.

d. DEMOGRAPHICS

- o Lower percentage who are male head of household.
- o More formal education.

- o Higher percentage whose occupation is professional/ managerial.
- o Higher income.

e. CORPORATE IMAGE

- o Dropped an average of six percentage points while competitive makes remained about constant.

4.4.3 1977 Chevrolet (Downsized) vs. 1976 Chevrolet (Not Downsized)

Table 4-10 identifies the significant differences between the 1977 Chevrolet buyers and the 1976 Chevrolet buyers. Fuel economy attributes are again significant discriminants with six of the eight fuel economy attributes being significant variables. Buyers of 1977 Chevrolet show:

a. FUEL ECONOMY

- o Higher percentage where expected gas mileage influenced decision to buy small car (30 percent for the 1977, 7 percent for the 1976).
- o Higher percentage where expected gas mileage influenced decision to buy this particular car (41 percent for the 1977, 24 percent for the 1976).
- o Better mileage - city and suburban.
- o Better mileage - highway.
- o Better fuel economy rating.
- o Better overall operating economy rating.

b. EVALUATIVE RATINGS

Better ratings on:

- o Usable trunk space.

Poorer ratings on:

- o Overall satisfaction.
- o Condition when delivered.

TABLE 4-10. 1977 CHEVROLET FULL-SIZES VERSUS 1976 CHEVROLET FULL-SIZES, AVERAGE PROFILES ON SIGNIFICANT VARIABLES

DESCRIPTIVE ASPECTS	1977 Chevrolet Standard	1976 Chevrolet Standard
Percentage who have owned this make before	78%	86%
Percentage whose car has 6 cylinders	14%	1%
Percentage whose car has automatic transmission	95%	99%
Purchase price -- net difference	$3,788	$3,467
EVALUATIVE RATINGS*		
Overall satisfaction	3.6	3.9
Condition when delivered	3.6	3.9
Overall exterior styling	4.0	4.3
Overall interior roominess	4.1	4.3
Overall interior comfort	4.1	4.3
Usable trunk space	4.3	4.1
Smoothness of transmission	3.5	4.1
Reliable, trouble-free operation	2.8	3.8
FUEL ECONOMY		
Overall operating economy rating	3.7	3.2
Mileage (fuel economy) rating	3.2	2.8
Percentage where expected gas mileage influenced decision to buy smaller car	30%	7%
Percentage where expected gas mileage influenced decision to buy this particular car	41%	24%
MPG -- city and suburbs	13.1	12.1
MPG -- highway	16.2	15.2
CORPORATE IMAGE		
Percentage Who Believe GM Has:		
Best looking cars	64%	73%
Most comfortable riding cars	58%	66%
Best engine performance	60%	68%
Best resale value	67%	78%
Percentage who would buy this make/series again	70%	81%
DEMOGRAPHICS		
Percentage male	76%	82%
Percentage who are male head of household	74%	79%
Age (in years)	49.6	51.1
Percentage who reside in metropolitan areas or big city suburbs	48%	43%

Discriminant function correctly classifies:
82% of 1977 Chevrolet Standard Buyers (401 out of 459)
95% of 1976 Chevrolet Standard Buyers (424 out of 445)

*Five point rating scale: Excellent = 5
Very good = 4
Good = 3
Fair = 2
Poor = 1

- Overall exterior styling.
- Overall interior roominess.
- Overall interior comfort.
- Smoothness of transmission.
- Reliable, trouble-free operation.

c. DESCRIPTIVE ASPECTS

- Higher percentage with 6 cylinder engine.
- Higher purchase price.
- Lower percentage who have owned this make before.
- Lower percentage with automatic transmission.

d. CORPORATE IMAGE

- Lower percentage among 1977 owners than 1976 owners who believe GM has:
  - Best looking cars.
  - Most comfortable riding cars.
  - Best engine performance.
  - Best resale value.

e. REPURCHASE INTENTIONS

- Lower percentage who would buy this make/series again. (70 percent for 1977 buyers, 81 percent for 1976 buyers).

f. DEMOGRAPHICS

- Lower percentage male.
- Lower percentage who are male head of household.
- Younger.
- Higher percentage who live in metropolitan areas or suburbs.

4.4.4 1977 vs. 1976 Buick, Oldsmobile, Pontiac, and Cadillac

Here again, the significant differences are similar to the differences between the 1977 and 1976 Chevrolet. And, as in the low priced segment, six out of the eight fuel economy attributes are also significant variables in the medium and high priced segments. Medium and high price buyers, however, are more sensitive to size; overall length, interior roominess, comfort, and smoothness of ride are rated lower. The 22 variables that distinguish 1977 from 1976 Buick, Oldsmobile, Pontiac, and Cadillac buyers, listed in Table 4-11, are summarized below. Buyers of 1977 Buick, Oldsmobile, Pontiac, and Cadillac show:

a. FUEL ECONOMY

- o Higher percentage where expected gas mileage influenced decision to buy a smaller car (17 percent for the 1977, 5 percent for the 1976).
- o Higher percentage where expected gas mileage influenced decision to buy this particular car (27 percent for the 1977, 16 percent for the 1976).
- o Better fuel mileage - city and suburban.
- o Better fuel mileage - highway.
- o Better fuel economy rating.
- o Better overall operating economy rating.

b. EVALUATIVE RATINGS

Better ratings on:

- o Ease of parking.

Poorer ratings on:

- o Condition when delivered.
- o Overall exterior styling.
- o Overall length.
- o Overall interior roominess.
- o Overall interior comfort.

TABLE 4-11. 1977 VERSUS 1976 BUICK, OLDSMOBILE, PONTIAC, CADILLAC, AVERAGE PROFILES ON SIGNIFICANT VARIABLES

DESCRIPTIVE ASPECTS	1977 B.O.P., Cadillac	1976 B.O.P., Cadillac
Percentage whose car has 6 cylinders	4%	1%
EVALUATIVE RATINGS*		
Condition when delivered	3.6	3.8
Overall exterior styling	4.0	4.4
Overall length	4.0	4.2
Overall interior roominess	3.9	4.4
Overall interior comfort	4.0	4.5
Smoothness of ride	4.3	4.6
Ease of parking	4.3	4.1
Smoothness of transmission	3.9	4.2
Reliable, trouble-free operation	3.1	3.9
FUEL ECONOMY		
Overall operating economy rating	3.9	3.1
Mileage (fuel economy) rating	3.3	2.7
MPG -- city and suburban	12.8	11.5
MPG -- highway	15.8	14.8
Percentage where expected gas mileage influenced decision to buy smaller car	17%	5%
Percentage where expected gas mileage influenced decision to buy this particular car	27%	16%
CORPORATE IMAGE		
Percentage Who Believe GM Has:		
Best looking cars	62%	72%
Most comfortable riding cars	60%	69%
Percentage who would buy this make/series again	72%	79%
DEMOGRAPHICS		
Percentage male	78%	81%
Percentage married	83%	87%
Percentage who are male head of household	74%	78%

Discrimant function correctly classifies:
92% of 1977 Buick, Oldsmobile, Pontiac, Cadillac buyers (994 out of 1082)
90% of 1976 Buick, Oldsmobile, Pontiac, Cadillac buyers (582 out of 645)

*Five point scale: Excellent = 5
Very good = 4
Good = 3
Fair = 2
Poor = 1

- Smoothness of ride.
- Smoothness of transmission.
- Reliable, trouble-free operation.

c. DESCRIPTIVE ASPECTS

- Higher percentage with 6 cylinder engine.

d. CORPORATE IMAGE

Lower percentage who believe GM has:

- Best looking cars.
- Most comfortable riding cars.

e. DEMOGRAPHICS

- Lower percentage male.
- Lower percentage married.
- Lower percentage male head of household.

f. REPURCHASE INTENTIONS

- Lower percentage who would buy this make again. (72 percent for 1977 buyers, 79 percent for 1976 buyers).

4.4.5 Variables That Distinguish 1977 GM Make/Series Loyals from Non-Loyals

Earlier tables indicated that 70 percent of the 1977 Chevrolet buyers and 72 percent of the 1977 Buick, Oldsmobile, Pontiac, and Cadillac buyers would buy the same make/series again. A two group discriminant analysis was run to determine the variables that distinguish loyals from non-loyals in each segment.

Details which appear in Table 4-12 and Table 4-13 are summarized below:

- Make/series loyals report higher MPG on both city/suburbs and highway driving.
- Make/series loyals rate the downsized GM cars better on styling/appearance/roominess dimensions.

TABLE 4-12. VARIABLES THAT DISTINGUISH 1977 MODEL CHEVROLET FULL-SIZED MAKE/SERIES NON-LOYALS FROM LOYALS

Variable	Means	
	Non-Loyals	Loyals
Overall exterior styling rating	3.6	4.2
Overall length rating	3.7	4.1
Overall interior styling rating	3.8	4.3
Overall interior roominess rating	3.7	4.3
Overall interior comfort rating	3.7	4.3
Smoothness of ride rating	3.9	4.4
Usable trunk space rating	4.0	4.4
Ease of parking rating	4.1	4.4
Maneuverability in city traffic rating	4.2	4.4
Overall operating economy rating	3.1	3.9
Fuel economy rating	2.7	3.3
MPG -- City and suburbs	12.5	13.4
MPG -- Highway	15.6	16.4
GM has best looking car	51%	69%
GM has most comfortable riding car	40%	66%
GM has best engine performance	50%	64%
GM has best resale value	59%	70%
Percentage male	78%	76%
Age (in years)	50.4	49.3
Formal education (in years)	12.1	12.6

Discriminant function correctly classifies:
71% of non-loyals (97 out of 136)
75% of loyals (241 out of 323)

TABLE 4-13. VARIABLES THAT DISTINGUISH 1977 MODEL BUICK, OLDSMOBILE, PONTIAC, AND CADILLAC MAKE/SERIES NON-LOYALS FROM LOYALS

Variable	Means	
	Non-Loyals	Loyals
Overall exterior styling rating	3.6	4.2
Overall length rating	3.6	4.1
Overall interior styling rating	3.9	4.4
Overall interior roominess rating	3.4	4.1
Overall interior comfort rating	3.6	4.2
Smoothness of ride rating	3.7	4.5
Usable trunk space rating	3.7	4.3
Ease of parking rating	4.1	4.4
Maneuverability in city traffic rating	4.1	4.5
Overall operating economy rating	3.3	4.1
Fuel economy rating	2.9	3.5
MPG -- City and suburbs	12.3	13.0
MPG -- Highway	15.2	16.1
GM has best looking car	46%	68%
GM has most comfortable riding car	45%	66%
GM has best engine performance	47%	65%
GM has best resale value	59%	73%
Percentage male	83%	76%
Age (in years)	52.1	51.0
Formal education (in years)	13.0	13.2

Discriminant function correctly classifies:
66% of non-loyals (200 out of 303)
78% of loyals (609 out of 779)

- Make/series loyals show higher evaluation of GM on appearance/comfort/performance/resale value.
- Make/series loyals exhibit:
  - Lower incidence of males.
  - Lower average age.
  - Higher formal education.
- In short, there is some evidence of:
  - A halo effect for make/series loyals.
  - An experience that is below expectation for non-loyals.

4.5 SUMMARY OF ANALYSIS RESULTS

The automotive industry regards the downsizing by General Motors Corporation of its full-sized cars as a massive endeavor that was brilliantly executed. It is clear that the product strategy developed by General Motors Corporation was very successful. Overall exterior dimensions were reduced without reducing interior package dimensions. Weight was reduced and significant improvements in fuel economy were achieved.

The car buying public responded favorably to the scaled down General Motors Corporation 1977 full-sized cars. Among the positive buyer perceptions, those who purchased the downsized cars did so with expectations (that were fulfilled) of better fuel economy, as well as increased maneuverability and ease of parking. Moreover, buyers of downsized cars also tended to reinforce the pursuit of fuel economy by choosing 6 cylinder engines and manual transmissions to a greater extent than occurred prior to downsizing.

The evidence is clear that the expectation of improved fuel economy was an important motivator in making a selection. There are dramatic differences in the percentage that indicated that expected gas mileage influenced the decision to buy a smaller car and to buy the particular downsized make selected.

That the downsizing did, in fact, result in better gas mileage is confirmed by buyers of 1976 and 1977 model year full-sized cars. The average miles per gallon reported by General Motors Corporation full-sized buyers increased by about 1.8 miles per gallon for city and suburban driving, and by almost 2 miles per gallon for highway driving in the 1977 model year. The average gas mileage reported by owners of Ford Motor Company and Chrysler Corporation full-sizes, on the other hand, remained almost constant.

Recognition of improved mileage is also reflected by owners' evaluative rating of gas mileage. Owner ratings of gas mileage, still at a low level of satisfaction, increased marginally among buyers of 1977 model year GM full-sizes, but remained constant among buyers of Ford Motor Company and Chrysler Corporation full-sizes.

On the negative side, the downsized General Motors cars were perceived to lack style, roominess, comfort, smoothness of ride, and adequate length. Buyers gave their car low ratings on transmission smoothness and reliable trouble-free operation. These do not necessarily follow from downsizing, and may reflect particular problems in the introductory year of an all-new car, a common occurrence in the industry.

In total, anticipation of increased fuel economy clearly was an important consideration. The cars were purchased in the face of lower satisfaction levels for styling and comfort. It appears that there will be a period of ambivalence where early adapters of the downsized cars experience both pleasure (through increased fuel economy) and lower levels of satisfaction with appearance and comfort. It is likely that an adjustment period of a year or two will improve adaptation to the smaller cars. It is conjectured that some of the negative associations with the downsized full-sizes will diminish with the 1978 model buyers due to temporal adaptation and the fact that the General Motors intermediates and intermediate specialities are also downsized this year.

The final validation of the acceptance of the 1977 General Motors downsized full-sizes comes from the market place. 1977 was a banner year for the industry, with the second highest sales in history. General Motors' downsized full-sizes increased its industry share of this expanded market.

While downsizing in the low priced full-sized segment was favorably received by previous Chevrolet owners, previous owners of General Motors medium and high priced cars (Buick, Oldsmobile, Pontiac, and Cadillac) exhibited some sensitivity to size and weight reduction. In total, however, even these downsized makes gained market share over 1976.

We can conclude that General Motors' downsizing of its full-sized cars not only was a significant fuel economy measure, but was a success in the market place as well.

5. LIGHT TRUCK DEMAND*

5.1 INTRODUCTION

This section covers the steadily growing light truck demand of the 1970's. A number of explanations for the growth in light truck demand, as seen in popular periodicals, are presented. Then, the cost and social acceptance explanations are analyzed more systematically in Sections 5.4 and 5.5. The final section deals with the actual sales trend of light trucks and Class II light trucks.

5.2 MAJOR FINDINGS

- The dominant themes in the popular literature on light trucks are:
  - (a) the increased personal use of light trucks,
  - (b) the increased use of light trucks for outdoor recreation, camping, and sports activities.
  - (c) the increased youth market for light trucks, and
  - (d) the increased customizing and added options for light trucks.
- The cost of operating light trucks at low annual mileages, is less than the cost of operating full-sized cars, and comparable to operating intermediate cars.
- Light truck ownership during the 1970's has become as prolific among the higher income population as in the middle income population.
- Between 1971 and 1977, there were losses in light truck ownership among farmers and self-employed business persons (the occupational groups that traditionally used

*This section covers light truck demand between 1970 and 1977. The primary research for Sections 5.3 and 5.4 was performed in the spring of 1978, for Section 5.5 in the spring of 1979.

light trucks) and gains in light truck ownership among professional, managerial, and clerical workers (the groups that had not used light trucks).

- o The primary use of light trucks is for personal, rather than business, use. Fifty-four percent of early 1977 model year pick-up buyers, 70 percent of sport/utility, 60 percent of suburban, 59 percent of van, 67 percent of passenger van, and 65 percent of compact pick-up early buyers used their trucks primarily for personal use.
- o Light truck sales accounted for 14 percent of the total new motor vehicle sales in 1971; this reached 24 percent by 1978.
- o The majority of new light truck sales had been in the heavier class II truck category (6001-10000 lbs GVW) due to EPA emissions standards on Class I trucks (0-6000 lbs GVW) beginning in the 1975 model year. Recent EPA emissions standards on many class II trucks have resulted in a decreased share of class II truck sales.

5.3 LIGHT TRUCK SALES AS SEEN IN POPULAR PERIODICALS AND TRADE JOURNALS

The popular literature on light truck sales has identified a diversity of market trends. There are a number of distinct markets which overlap in inducing a particular individual to buy a particular vehicle. No single dominating market trend or theme emerges.

Dominant themes apparent in the literature are: 1) increased personal use; 2) the youth orientation; 3) outdoor recreation, camping, and sports; 4) versatility, customizing, and options; and 5) cost.

1) Increased Personal Use - Most light trucks are used a large fraction of the time for personal and not business purposes.

2) Youth Orientation -- Light trucks have become increasingly important in the youth market. An increased share of light truck sales have been to those under age 30.

3) Outdoor Recreation, Camping, and Sports -- These activities are primary among the personal uses of light trucks; they determine the strong sales of four-wheel drive vehicles. The outdoor recreation market varies greatly by region and may consist of distinct socio-economic groups.

4) Versatility, Customizing, and Options -- Buyers invariably want versatility which enables them to mix business and personal use of vehicles. In addition, they desire the flexibility to add the options they want and the opportunity to individually customize their vehicles.

5) Cost -- Claims are made that light truck ownership may not be more costly than car ownership over the full life cycle, especially when substituting for the family sedan.

The literature does not compare the importance of these emergent and visible themes to the traditional commercial uses of light trucks. The literature is dominated by attitudes favorable to these vehicles; however, critiques by a customer organization experienced in comparative testing of passenger cars are, generally, unfavorable toward light trucks.

The auto company marketers are attempting to cater to the increased personal use of light trucks. In this respect, they see versatility as the most important attribute they have to offer. However, they have not lost sight of the fact that the traditional values of durability and effective commercial utility remain important, with the latter dominating the choice of many vehicles. Finally, they realize that they cannot displace small entrepreneurs in customizing services, and they are moving cautiously into interior design variants.

The material for this analysis was derived from a variety of newspapers and periodicals, including:

Automotive News
Pickup, Van, and 4 Wheel Drive
Ward's
Popular Science
Consumer Reports
The New York Times
The Boston Globe
Money Magazine
Fortune Magazine

The Reader's Guide to Periodical Literature was also used. The literature search covered the period of September 1976 to January 1978, though not all sources were searched for that entire period.

Primarily, a picture emerges regarding statements of auto industry spokesmen to the press. Secondarily, observations and interpretations are made by the press concerning the light truck market. This information is interesting but non-systematic, and has several limitations as indicated below.

First, the information is not statistical. A few numbers are given to support the broadest observations about trends but detailed market studies and sales records, which would clarify the tougher questions, are not used. Some data covering special subgroups of truck owners are given in the tables at the end of this report.

And second, the principal trend in sales or some segment of sales is usually described to the exclusion of other trends. For example, it is stated that "40 percent of buyers are under age 30" for a particular model. The silent majority who account for 60 percent of sales are implicitly ignored. It is not explained whether the 60 percent represents a group whose purchases are not increasing, or whose purchases are merely increasing at a rate somewhat different from those of younger buyers. This sort of interpretation is rarely presented.

5.3.1 Dominant Themes

5.3.1.1 Personal Use - The statement that the increase in light truck sales is due largely or wholly to increased personal use has been made by auto company officials. William Benton, Ford Division general manager, stated the following:

> "Light trucks are being used increasingly for personal transportation, especially among young people. What's even more important, many light truck purchases substitute for cars, with club wagons leading the pack. In this market, two of three vehicles sold are car substitutes."[1]

James Riley, Chevrolet truck sales manager, agreed with Benton when he stated that "the biggest increase in truck demand has been in the personal usage market."[2]

A reflection of the increased personal use of light trucks is the increased ordering of comfort options. That is the thrust of the following assessment in an article entitled "Trucks Muscle In on the Car Market," in Fortune Magazine, February 27, 1978.[3]

> "A decade ago, truck buyers had a choice of wheel bases and body sizes. Today, option lists for all types of trucks rival - and often outstrip - those available on the most expensive automobiles. Most truck buyers go for automatic transmissions, power steering, radios, and at least some upholstery and trim packages.
>
> "Other increasingly popular options include power brakes, tilt steering wheels, power windows, and even automatic speed control. In many cases, it is possible to spend more on options than on the basic truck. The base price of the Chevrolet Blazer, for example, is about $4,900, but the option list runs to some 120 items, including tire choices. The Blazer buyer typically spends nearly $8,000, but could theoretically lay out more than $11,000."

Many buyers are loading up their trucks with options, even going to considerable luxury. This is expressed in the article "Light Trucks Equal Heavy Sales" in the New York Times.[4]

[1]References at end of Section 5.3

"The truck makers have done their best to make the products as luxurious as possible. Virtually every known accessory, comfort, and option available on a car can be found on light trucks - and more. Few cars, for example, have the swiveling captain's chairs and lush carpeting that give some vans an extra touch of luxury.

'They've made them so fancy today,' Mr. Lamb [owner of a Detroit garage that specializes in four-wheel-drive vehicles] said, 'that you can go to the fanciest hotel or dining room or restaurant and find as many pickups in the parking lot as you do luxury cars.' Finally, light trucks lend themselves to individual expression better than cars. There is more surface to decorate."

A Dallas area survey[5] indicated that more than half of the buyers of pickups were trading in a car. This supports the assumption of increased personal use.

5.3.1.2 Youth Orientation - A variety of articles in many sources observe the increase in sales of customized vans (or vans to be customized by their owners) to young people. The customizing jobs are often colorful and expensive. For example, from the Boston Globe:[6]

"Pat Mackie editor of Custom Vans magazine, said that the average vanner will spend about $4000 to $5000 on modifications. But, it's not unusual to see one that has had $20,000 put into it."

"There is a rapidly growing list of nearly 1000 van clubs in the United States...rarely a weekend passes without one of them playing host to a truck-in. One in Kentucky last year drew 6000 vans.

"Hard core custom vanners like to consider themselves members of an exclusive group, sneering at vans with side windows, which they call 'station wagons.' "

And, from the same source, this sociological gem:

"Said one vanner, 'It's an identity thing. It gets so that everyone can sort of put you together with your truck. So, when I pull into a truck-in they maybe can't see me but they know I'm there because of my truck.' "

The New York Times[7] informs us:

"Some of the hot-rod magazines are now hailing light trucks as the 'super-cars of the 1970's.' One of the magazines, Car Craft, says they 'look mean enough to break your face.' That's the way the muscle cars used to be described...'The adult toys,' a Dodge advertisement calls them."

Car makers have responded to the customizing trend in their ads and in their design of certain models. The Chevy Caravan van option, for example, is a finished interior especially suited for individualized customizing: insulation and finished plywood paneling for the entire roof and rear-compartment doors and walls, full-length, black-rubber floor mat with insulation, and swivel, high-back, bucket seats with reclining seat backs.[8]

Flamboyant customized vans are often used as the example of the larger category of vans. These categories include:

1. Vans of all types owned by young people;
2. Vans which are customized, but in unflamboyant ways; and
3. Recreational usage of vans.

Thus, the total youth market for light trucks is anticipated to be much broader than the customized market.

Paul Manske, Ford light truck marketing plans manager, stated that the 4 WD pickup is a non-customized flamboyant family vehicle for the young.[9]

"The personal-use truck is a youth vehicle: Take the 4wd pickup, 46 percent of them were sold to persons under 30 last year, compared with 33 percent back in 1973.

"When you take a look behind statistics like that you find that many young buyers of light trucks are married and have children, even though they are under 30.

"Just as important is the fact that young buyers of Bronco-type vehicles do something more than just travel in them. It may be fishing, camping, vacationing at a remote cottage or any one of a hundred other things. Just about all of them call for some kind of bulky equipment, even if it's only the food taken to a remote cottage for a quiet weekend.

"Combine a family with children and a big collection of bulky cargo and you know the customer will be looking for a vehicle with good interior space."

Ford already has a fairly clear picture of who will be buying the new Bronco. Manske said about 40 percent of buyers will be under 30, more than 50 percent will be married and have children, the vehicles will carry four people one or two times a week, and more than 95 percent will be employed for personal use at least some of the time.

The chairman of the Recreational Vehicles Industry Association (RVIA) Marketing Research Committee reinforced the youth orientation with his statement on RV buyers:

"Sales trends in the RV field indicate that young couples are purchasing camping vans instead of cars or station wagons as first vehicles, and often trade-up to a larger camper unit after starting a family."[2]

5.3.1.3 Outdoor Recreation, Camping, and Sports - The overlapping set of uses of outdoor recreation, camping, and sports is so frequently and casually mentioned as to qualify as common practice in trade journals. The variety of images brought to mind or focused on in different sources can differ substantially. Thus, Pickup, Van, and 4WD will contain an article on a pickup truck outfitted for desert travel with three motorcycles carried in the back, another source will contain an article on a fisherman headed for a remote stream, and the RVIA will present an image of camping and and family togetherness:

"We believe there is a new emergence...of camping as the best method in our complex society to promote family togetherness."[2]

RVIA has a statistical publication[10] which covers travel trailers, fold-down camping trailers, motor homes, truck campers, and pickup covers. Although sales data (see Table 5-1) are not directly relevant to light trucks (only the van camper type of mobile home is a light truck), it is an indicator of outdoor recreation that we would expect to be highly analogous to outdoor

TABLE 5-1. RECREATIONAL VEHICLES: PERCENT OF 1976 SHIPMENTS BY REGION

	North-east	South-east	East North Central	South Central	West North Central	Mountain	Pacific
Travel Trailers	15.82	15.54	20.98	10.79	11.31	8.07	17.57
Fifth Wheel	6.05	5.37	15.34	12.78	16.46	12.98	31.01
Fold-Down Camping Trailers	19.11	17.53	26.34	10.93	13.83	5.10	7.17
Truck Campers	9.29	7.36	17.71	17.21	18.69	15.11	14.63
Motor Homes							
Conventional	9.91	17.15	27.29	11.88	9.72	7.10	16.96
Van Camper	10.81	14.74	26.17	7.01	6.36	5.86	29.27
Chopped Van	12.59	9.51	20.82	9.74	11.91	11.13	24.29
Total Vehicles	13.80	13.68	22.17	11.03	12.29	8.76	18.26

Source: Reference 10.

recreation use of light trucks. For example, the fifth wheel trailers and truck campers are designed for use with a pickup truck.

The East North Central region had the most shipments of recreational vehicles in 1976 (see Table 5-1), but the regional per capita leader in RV sales was the Mountain region (see Table 5-2). In general, RV sales are strong where truck ownership is high (see Figure 2-9).

The same types of recreational vehicles are covered in a survey by Woodal's[11] (the company most popularly known for its campground guides). The Woodal's data come with no description of how the survey was done or any indication of its statistical validity, but it does give interesting socio-economic data. One imagines the data may have been obtained by a survey of Woodal Campground Guide buyers. In the Woodal's study, the typical RV owner is quite different from others pictures above. He:

1. Is retired or professional/executive/manager,
2. Owns a travel trailer,
3. Has an income of $15,000 - $25,000,
4. Is a high school graduate or more, and
5. Is over 45.

For more detail, see Table 5-3.

Note that Woodal's RV respondents again are not directly relevant to the light truck market, but may be analogous to a segment of that market. Note that the majority of respondents have travel trailers which they probably towed with their automobiles. If heavy, powerful cars become unavailable as a result of fuel economy standards, they may need pickups to pull these trailers.

A different picture is given in a survey by Pickup, Van, and 4WD (PV4) of its 180,000 readers.[12] (See Table 5-4.) This survey was done by a respected research firm, obtained an amazing 83.7 percent response rate, and was designed primarily with potential advertisers in mind. The following attributes characterize a typical PV4 reader:

TABLE 5-2. RECREATIONAL VEHICLES: RATIO OF PERCENT OF 1976 SHIPMENTS TO PERCENT OF POPULATION, BY REGION

	North-east	South-east	East North Central	South Central	West North Central	Mountain	Pacific
Travel Trailers	.68	.72	1.10	1.09	1.44	1.75	1.31
Fifth Wheel	.26	.25	.80	1.29	2.10	2.82	2.31
Fold-Down Camping Trailers	.82	.81	1.38	1.10	1.76	1.11	.53
Truck Campers	.40	.34	.93	1.74	2.38	3.28	1.09
Motor Homes							
Conventional	.42	.79	1.43	1.20	1.24	1.54	1.26
Van Camper	.46	.68	1.37	.71	.81	1.27	2.18
Chopped Van	.54	.44	1.09	.98	1.52	2.42	1.81
Total Vehicles	.59	.63	1.16	1.11	1.57	1.90	1.36

Source: Table 1a, and Bureau of the Census estimates of resident population by State for July 1, 1976. (Reference 25)

TABLE 5-3. SURVEY OF RECREATIONAL VEHICLE OWNERS (SHEET 1)

RV OWNERS	
RETIRED	25.0%
PROFESSIONAL/ EXECUTIVE/MANAGER	36.3%
CLERICAL/SALES/SERVICE	5.9%
BLUE COLLAR/SEMI-SKILLED	15.5%
LABORER/UNSKILLED	2.8%
FARMER	2.0%
MILITARY	0.5%
STUDENT	0.2%
OTHER	11.8%
RV TYPES	
TRAVEL TRAILERS	56.5%
TENT TRAILERS	10.6%
TRUCK CAMPERS	8.9%
MOTOR HOMES	15.8%
VAN CONVERSIONS	3.4%
TENTS	2.3%
OTHER	2.5%
ANNUAL HEAD OF HOUSEHOLD INCOME	
UNDER $5000	2.8%
$5000-$9999	8.0%
$10,000-$14,999	20.2%
$15,000-$24,999	45.2%
$25,000 UP	23.8%

Source: Reference 11

TABLE 5-3. SURVEY OF RECREATIONAL VEHICLE OWNERS (SHEET 2)

HIGHEST EDUCATION - HEAD OF HOUSEHOLD	
NOT HIGH SCHOOL GRADUATE	15.4%
HIGH SCHOOL GRADUATE	32.1%
SOME COLLEGE	23.4%
COLLEGE GRADUATE	15.2%
POST GRADUATE WORK	13.9%
AGE - HEAD OF HOUSEHOLD	
UNDER 25	0.5%
25-34	8.0%
35-44	20.7%
45-54	27.2%
55-64	30.4%
65 OVER	13.2%
REPLACE TOW VEHICLE	
1 YEAR	1.4%
2 YEARS	4.1%
3 YEARS	11.0%
4 YEARS	13.1%
5 YEARS	15.9%
6 YEARS	12.4%
7 YEARS	13.8%
8 YEARS	10.0%
9 YEARS	17.2%
RV OWNERSHIP	
OWN RV	98.0%
RENT	1.4%
BORROW	0.6%

TABLE 5-3. SURVEY OF RECREATIONAL VEHICLE OWNERS (SHEET 3)

CAMPING VACATION MILES			
MILES TRAVELED	1974	1975	1976
1-100	16.0%	12.2%	17.3%
100-1000	21.5%	23.5%	17.7%
1000-2000	16.0%	17.0%	17.0%
2000-3000	12.4%	11.3%	12.6%
3000-4000	9.9%	11.2%	9.5%
4000-5000	7.6%	6.6%	7.1%
>5000	16.5%	18.2%	18.8%

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZINE (SHEET 1)

Age	Subscribers	Principal Readers
Total Answering	*990*	*1424*
	100.0%	*100.0%*
Under 18	3.7%	9.8%
18 - 24	21.0%	22.9%
25 - 34	39.9%	35.6%
35 - 49	24.7%	21.3%
50 - 64	9.4%	9.4%
65 and Over	1.3%	1.0%
Median Age	*31.2*	*29.4*
Number not answering	*10*	*23*
Sex		
Total Answering	*1000*	*1447*
	100.0%	*100.0%*
Male	95.5%	75.1%
Female	4.5%	24.9%
Number not answering	--	--
Position in Household		
Total Answering	*997*	*1444*
	100.0%	*100.0%*
Male Head	84.8%	58.1%
Female Head	4.4%	22.1%
Other Male	10.8%	17.0%
Other Female	---	2.8%
Number not answering	*3*	*3*
Marital Status		
Total Answering	*995*	
	100.0%	
Married	70.4%	
Single	25.8%	
Separated/Widowed/Divorced	3.8%	
Number not answering	*5*	

Source: Reference 12.

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZINE (SHEET 2)

Education		Subscribers	Principal Readers
Total Answering		*995*	*1434*
		100.0%	*100.0%*
Attended High School or Less		10.8%	16.8%
Graduated High School		39.7%	39.9%
Attended College (1–3 years)		27.1%	25.0%
Graduated from College and Beyond		22.4%	18.3%
Graduated from College	8.6%		7.5%
Did Postgraduate Work	6.9%		5.5%
Received Postgraduate Degree	6.9%		5.3%
Number not answering		*5*	*13*

Household Income			
Total Answering		*954*	*1380*
		100.0%	*100.0%*
Less than $10,000		13.6%	12.2%
$10,000 – $14,999		22.9%	23.2%
$15,000 – $19,999		22.1%	22.2%
$20,000 – $24,999		17.9%	18.6%
$25,000 – $34,999		14.5%	14.4%
$35,000 and Over		9.0%	9.4%
Median Income		*$18,081*	*$18,306*
Number not answering		*46*	*67*

Employment Status		
Total Answering	*991*	
	100.0%	
Employed	90.0%	
Full Time	84.9%	
Part Time (Less than 30 hours per week)	5.1%	
Temporarily Unemployed	4.3%	
Not Emplc,ed/Retired	5.7%	
Number not answering	*9*	

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZINE (SHEET 3)

Title of Household Head	Subscribers
Managers, Officials, Proprietors	26.7%
Top Management (Officials, Directors, Owners)	6.0%
Middle Management (Division Heads, Administrators, Managers)	10.3%
Proprietors (Owners or Partners, Small to Medium Firms)	10.4%
Professional/Technical	13.6%
Doctors, Dentists, Lawyers	3.1%
Educators	3.6%
Other Professional and Technical	6.9%
Government	13.3%
Sales	1.7%
Clerical	0.8%
Craftsman, Foreman	16.8%
Other Business	21.2%
Retired	2.7%
No Answer/Not Employed	3.2%

Base: 1000 – All subscribers

Value of Home Owned	
Total Answering	*983*
	100.0%
Own Home	75.5%
Under $20,000	13.0%
$20,000 – $29,999	16.3%
$30,000 – $39,999	17.6%
$40,000 – $49,999	13.8%
$50,000 – $74,999	10.5%
$75,000 – $99,999	2.5%
$100,000 or More	1.8%
Don't Own Home	24.5%
Median Value of Home (based on those owning)	*$34,855*
Number not answering	*17*

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZINE (SHEET 4)

Number of PV4 Vehicles Owned		Subscribers
Total Answering		*999*
		100.0%
Any		87.6%
One	57.4%	
Two	25.3%	
Three or More	4.9%	
Don't Own		12.4%
Median PV4 Vehicles Owned		*1.3*
Number not answering		*1*

Types of PV4 Vehicles Owned

Pickup (2 or 4WD)	64.6%
Van	17.3%
4WD Utility	47.4%

Base: 875 – All subscribers who own a pickup, van, or 4WD utility.

Note: Adds to more than 100.0% due to multiple responses.

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZIN (SHEET 5)

Factory Installed Equipment	PV4 Vehicle Owners
Power Steering	55.7%
Power Brakes	54.5%
Locking Hubs	42.4%
Limited Slip	29.5%
Winch	3.1%
Auxiliary Tank	21.7%
Air Conditioning	27.9%
Bucket Seats	29.4%
AM Radio	63.0%
AM/FM Radio	12.3%
Tape Deck	5.7%

Base: 875 — All subscribers who own a pickup, van, or 4WD utility.

Note: Columns add to more than 100.0% due to multiple responses.

Equipment Added Since Vehicle was Purchased	
Larger Tires	63.0%
Heavy Duty Shocks	44.8%
Rollbar	16.9%
Driving Lights	25.1%
Exhaust System/Headers/Duals	32.1%
Wheels	40.1%
Air Conditioning	5.7%
Camper Shell	22.6%
Slide-on Camper	6.7%
Stereo/Tape	28.2%

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZINE (SHEET 6)

Equipment Added Since Vehicle was Purchased	PV4 Vehicle Owners
CB Radio	31.1%
Scanning Monitor	4.2%
Auxiliary Tank	16.7%
Locking Hubs	8.5%
Custom Interior	13.5%
Vents and Windows	6.7%
Grill Guard	12.1%
Transmission Oil Cooler	7.4%
Ignition System	11.1%
Overdrive	1.8%
Engine Swap	7.0%
Transmission Swap	3.2%
Convertible Top	3.7%
Sunroof	2.1%
Custom Paint	9.4%
AM/FM Radio	19.5%
Gauges/Instruments	23.5%
PTO Winch	2.2%
Electric Winch	8.6%
Suspension Kit	7.7%
Tire Carrier	22.4%
Special Seats	8.7%
Flares/Louvres/Vents	5.5%
Special Carburetion	11.1%
Special Manifold	6.9%
Special Camshaft	3.0%
Skid Plate	10.2%
4WD Conversion	0.6%
Motorcycle Rack/Tiedown	6.4%

Base: 875 – All subscribers who own a pickup, van, or 4WD utility.

Note: Columns add to more than 100.0% due to multiple responses.

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZINE (SHEET 7)

Length of Time Driving PV4 Vehicles		Subscribers
Total Answering		*952*
		100.0%
Have Driven PV4 Vehicle		97.5%
Less than 1 Year	6.8%	
1 Year	7.0%	
2 Years	8.9%	
3 Years	12.0%	
4 Years	8.7%	
5 Years or Longer	54.1%	
Have Not Driven PV4 Vehicle		2.5%
Median Years (based on those driving)		*5.2*
Number not answering		*48*

Ways in Which PV4 Vehicles are Used	
Commercial/Business	24.9%
Daily Transportation	77.0%
Recreation/Vacation	76.9%
Competition/Club Activity	3.2%
Other Uses	9.7%

Base: 875 – All subscribers who own a pickup, van, or 4WD utility.

Note: Adds to more than 100.0% due to multiple responses.

TABLE 5-4. THE PRINCIPLE READERS OF PICKUP, VAN & 4WD MAGAZINE (SHEET 8)

Miles Driven in Past Year—PV4 Vehicles	Subscribers
None	0.1%
Under 1000 Miles	2.6%
1000 – 4999 Miles	13.1%
5000 – 9999 Miles	26.1%
10,000 – 14,999 Miles	29.5%
15,000 – 19,999 Miles	14.2%
20,000 Miles and Over	14.4%
Median Miles Driven (based on those owning PV4 vehicle)	*11,393*

Base: 875 – All subscribers who own a pickup, van, or 4WD utility. Total Answering – 856.

Percent of Mileage Off-Pavement		
Any		91.5%
1 – 5 Percent	31.7%	
6 – 10 Percent	20.7%	
11 – 15 Percent	10.0%	
16 – 20 Percent	8.4%	
21 – 30 Percent	8.3%	
31 – 40 Percent	5.6%	
41 – 50 Percent	2.9%	
Over 50 Percent	3.9%	
None		8.5%
Median Percentage of Mileage		*9.4%*

Base: 855 – All subscribers who own a pickup, van, or 4WD utility. Total Answering – 852.

1. Male (95%),
2. Married (70%),
3. 31 years old,
4. Graduated from high school or better,
5. Makes $18,000 and owns his home (75%),
6. 88% own a PV4 vehicle and 30% own more than one, most often a pickup or 4WD utility.
7. Spent $382 on accessories/equipment during the past year,
8. Owns $525 worth of tools,
9. Drives the vehicle off-road as well as on (92%),
10. Has many factory installed options on vehicle, and
11. Has added many more features himself.

The PV4 vehicles are used as follows:

1.	Commercial/Business	24.9%
2.	Daily Transportation	77.0%
3.	Recreation/Vacation	76.9%
4.	Competition/Club	3.2%
5.	Other	9.7%

Thus, multiple use is significant.

In short, the PV4 reader is a young, active family man with diverse recreational interests. He does considerable work himself on outfitting his light duty truck, and his truck is an integrated part of a distinctive life style.

5.3.1.4 Versatility, Customizing, and Options - These related themes for light duty trucks are frequently mentioned. Some statements by Donald Bouchard, Chevy truck sales manager, indicate how the versatility of the light truck encourages multiple use:

> "I think the tremendous versatility of the van just about guarantees that more growth lies ahead for that type of vehicle. I have been impressed with the innovative ways people find to get two or three uses out of their vans.
>
> "For instance, you can do a lot of customizing of a van to develop a great fun vehicle for the weekends,

but that same vehicle can still be used for work during the week. Even with a lot of customizing on the interior, there is still plenty of space on the inside for a salesman to carry his samples.

"Now that we have the plant capacity to get out more vans, we are in a position to work with our salesmen and their customers on even more innovative uses of vans.

"None of us is sure just how high van demand can go. I look at the increased capacity as giving us a chance to satisfy the needs of our customers of all types. On the commercial side, I am sure there are business uses of vans which have never been pushed because the trucks were in short supply. I know that some commercial users were not able to get all of the vans they wanted as soon as they wanted them in the past.

"Truck manufacturers have always had trouble getting a handle on how most vans are used. A few, such as those purchased by telephone companies, are business vehicles 100 percent of the time. A few have replaced automobiles and are used for personal travel all of the time.

"In the middle is the large group of vans which is used for both work and play. The trouble is that no one has a good rule on how much a van must be used in business to be considered a good commercial model. The customized van with the salesman's samples in the back is mighty hard to categorize. And what about the family van that the father uses to drive back and forth to his job during the week, providing rides for several of his co-workers?"[13]

Multiple use is probably enhanced by the wide range of options available for trucks. This permits the buyer to specify a package of options which will maximize the number of uses he can get out of the truck, adapting the truck to his own particular needs. Consumer Reports,[14] in its review of pickup trucks, notes that "the choice of options for pickups is much greater than for passenger cars, and options can change a pickup's character much more than they change a sedan's." Also, it may be noted that GM's projected 1980 compact-size station wagon, called the MPC vehicle, is a combination of van and wagon features with as many as 15 to 20 applications:

"These range from its use as a conventional station wagon to an airport shuttle car, ambulance, police scout car, a camper, etc. It is said to be van-like in its versatility but car-like in its comfort and stylishness..."[15]

An assessment of truck versatility, its new implications, and its impact on auto manufacturers is provided in the Fortune Magazine article cited earlier:[3]

> "What happened, automakers now agree, was that the industry stumbled almost accidently into a major change in the nation's life-style. Americans were redefining "mobility," always one of their most cherished routes for the pursuit of happiness. Once, mobility signified simply the ability to get freely from one place to another; gradually the concept came to encompass a more purposeful sort of leisure-time motion with a variety of specific goals.
>
> "People were spending more time out-of-doors, typically in remote settings that required the long-distance hauling of such impediments as boats, off-road motorcycles, or great mounds of camping equipment. Others were devoted to ambitious do-it-yourself projects - building additions to homes, erecting summer cabins - or venting their acquisitive urges upon numerous objects that needed to be lugged from here to there.
>
> "For participants in this life-style, the truck was the natural vehicle, and only a modest effort by truck makers was required to tap the market. The most important thing they did was to give hitherto spartan trucks a smoother ride quality and all those optional amenities. The result was the most versatile and easily individualized vehicle ever produced.
>
> "It is even more versatile when it has four-wheel drive. Off-road driving is one obvious use - the humblest four-wheel-drive vehicle can scale breathtaking slopes and slog through the muddiest rut of a roadway - but a growing number of people are ordering the option as winter driving insurance. With four-wheel drive, it is possible to motor effortlessly and far more safely through axle-deep snow or along ice-slick highways."

Versatility and/or options are highlighted in the one-sentence summary characterizations in the Pickup, Van, and 4WD 1977 Test Review of PV4 vehicles tested during the year.[16] There, the Ford Ranchero pickup is described as "a blend of temperature control, tape deck, and horsepower." The Chevrolet Beauville is "a luxury window van for travelling, camping, and commuting." The Jeep Wagonner 4WD utility is "a smoothie on city streets and tough in the outback."

Van and pickup customizing is an area for promising new business ventures. Illustrating this theme are two recent advertisements for franchises in Automotive News.[17,18] One states:

> "If you need a good reason to be an Alpha Conversion dealer, here are five:
> 1) Alpha Conversions make every van sale easier. Customers who are turned off by factory equipped vans are ready to buy when you show them the unique styling and special appointments of Alpha Conversion Packages - plush bucket seats, dinette/lounge areas, refrigerator and convertible bed, plus rich color keyed carpeting.
> 2) All these interior extras mean more profits for you on every sale.
> 3) Every Alpha Conversion is an automotive quality vehicle. You can be proud of what you sell without worrying about comebacks.
> 4) Alpha Conversions limited warranty is for 12,000 miles or 12 months, same as the factory.
> 5) Alpha will back your sales effort and steer customers to your door with a hard hitting advertising program."

The other is entitled "Gladiator, Inc.: Your Own Profit Kingdom."

> "Interested in opening up a new world for yourself? Let Gladiator, Inc. introduce you to a higher profit margin and three sure-fire customer pleasers - vans, hi-top campervans, and pick-ups.
>
> "At Gladiator, Inc. we convert Dodge, Ford, Chevrolet, and GMC vans and pick-up trucks into attention-drawing vehicles that will help attract more people to your dealership. Our craftsmanship is of the highest quality, our prices competitive. With this combination you can build in your own profits and please customers at the same time."

Finally, the motor vehicle manufacturers and dealers are naturally interested in capturing some of the high-profit customizing market themselves. One move in this direction is shown in Automotive News[17] with a photograph of beer drinkers outside a van. The photo is captioned "Now that's tailgating!"

> "...a Dodge Dealer's tailgate party at a recent Vikings football game. Specially dubbed 'tailgater' conversions of Sportsman wagons were circled in the parking lot for a pre-game Bar-B-Q. Following the game, dealers drove the 75 tailgaters back to their respective showrooms in Wyoming, North Dakota, South Dakota, Wisconsin, and Minnesota."

The dealers are attempting to sell versatility and customizing.

5.3.1.5 Cost* - From time to time, it is noted that trucks can be as economical to operate as cars. The following quotation from an article in Money Magazine[19] can be taken as suggesting trucks are sometimes even cheaper:

> "Many pickups are as economical to operate as cars, and dealers say pickups retain relatively higher resale value than cars as the years pass."

The New York Times[7] notes:

> "Trucks or vans have the space that a large family needs. They cost about the same as a full-size sedan and deliver comparable gasoline mileage."

There can be special cost factors affecting the particular truck model chosen. A customized van equipped with an appliance such as a refrigerator can sometimes qualify for the lower motor home financing rate. And Arnold Jones, district manager (New England) for Dodge, notes:

> "One reason the pickup truck market is holding up is that the insurance rates have not yet been driven up. The vans used to be cheap to insure and young people bought them when they could no longer afford to insure hopped-up cars. Now the van insurance rates are up, and young buyers are turning to pickups."[2]

And the same fact is noted in the Money Magazine article quoted above:[19]

> "L. P. Schinzing, truck merchandising manager for Chevrolet, points out that insurance companies have raised rates severly on 'muscle cars'--like some Chevrolet Camaros and Dodge Chargers. So far, no special rates have been imposed on pickups with large engines. The largest pickup engines, around 450 cubic inches, are equivalent to the biggest engines in passenger cars. But at low speeds and when empty, trucks geared to haul a load will often get better acceleration than cars."

5.3.1.6 Miscellaneous Themes and Evaluations - A variety of other advantages of trucks, centering on their greater power and cargo

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* See Section 5.4 for a detailed cost comparison between cars and light trucks.

space as well as their off-road capabilities, is mentioned in the literature. Often it is not clear whether it is being claimed that these characteristics are important reasons for increased truck sales, or are merely being listed as part of a complete run-down of possible truck advantages. They can be thought of as technical characteristics supporting the more general uses described earlier, such as recreation. Sometimes, however, they are pointed to as the specific reason for truck sales:

> "Auto salesmen say they have sold trucks to customers disappointed with the reduced-size standard General Motors station wagons that were introduced a year ago...
>
> "Many first-time pickup owners made the switch because of the difficulties they had using passenger cars to tow heavy trailers. The engine and suspension of most cars aren't adequate for towing a large trailer. With a pick-up you can tailor axle and suspension options to the size of your trailer."[19]

Gas mileage is often said to be pretty good, and more lenient emissions standards which permit use of leaded gasoline and hence higher compression engines is sometimes noted.*

The average or typical truck or van buyer is described in one source as follows:

> "The average truck buyer today is not much different from the average car buyer. According to demographic data from Chevrolet (which is representative of the industry), the typical buyer of a new pickup truck has a household income of some $17,500 a year, compared with $17,600 for Chevette buyers and about $19,000 for buyers of standard Chevrolets. The typical van owner is the thirtyish head of family with one or two children, with a household income close to $18,000. More than half of van buyers are professionals, technical workers, managers, proprietors, or skilled tradespeople; 25 percent are college graduates and another 37 percent have at least some college or vocational training."[3]

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*Also see Section 5.6.

Manufacturers and dealers should take heart from this assessment, which, if it is to be believed, would imply that the potential market for light trucks is quite large.

The same Fortune Magazine article also offers this piece of amateurish sociology:

> "The truck is the new lover, full of glamour and promise for daring but untried adventures. A great many truck owners may never go bounding up rocky trails, or haul the lumber and Sheetrock to build a new home, yet they can enjoy the thought that they *could*; having a truck enlarges their choice about how to live.
>
> "Driving a truck, moreover, can be a lot more fun than driving an automobile. The truck has character, and it has power; it stokes the ego. From his high and secure seat in the cab, the driver can look down - literally and figuratively - upon the humdrum swarms of automobiles on the freeway and feel set apart from the crowd. And despite the "macho" image of the truck - or even because of it - women are increasingly driving trucks."

Finally, it should be noted that most of the magazines quoted are written for an audience that is enthusiastic about light trucks, and the articles reflect this enthusiasm in one degree or another. The notable exception is Consumer Reports. In its review of light pickup trucks,[14] the opening paragraph is representative of its overall unenthusiastic view of them.

> "CR tests light pickup trucks from time to time, not as a service to building contractors, but as a guide to the many families that use a pickup truck as a kind of super station wagon."

The article goes on to complain about the lagging safety standards and poor gas mileage for pickups as compared with passenger cars. It cautions against poor ride quality of heavier trucks:

> "Some buyers of pickups may be tempted to 'play it safe' and order a truck with a much higher GVWR than they need. That's not a good idea. The extra-stiff springs, heavy axles, and large tires on trucks built for heavy loads result in a kidney-pounding ride and, often, inferior handling."

The Consumer Reports view of three vans[20] is loud and clear:

> "When we tested a group of vans six years ago, we found that they suffered from a variety of safety problems, including substandard braking and handling. We also pointed out that those 1971 vans felt very trucklike--that is to say, uncomfortable. We advised readers not to buy a van unless they absolutely needed its space.
>
> "That advice still holds. True, our vans brake and handle better than the 1971 models. They even feel more like passenger cars. But they still lack much of the safety equipment required in passenger cars. And with nothing but higher gasoline prices ahead, vehicles that get only 8 or 9 mpg in city driving and 14 mpg on a trip are hard to justify on economic grounds alone."

CR specified van models with a full set of options--making them expensive--and emphasized a number of difficulties of vans: difficulty in maneuvering in close quarters, dangerous blind spots, difficulty in climbing in or out of the driver's seat and the second seat, and others. It would appear that whether vans are good substitutes for cars is a question with several subjective elements to one's response.

5.3.2 Views Of Auto Company Marketers

The basic themes tend to be summarized and combined in general statements by auto company officials. The following is a representative sample of the manufacturers' overall conceptions of the market and the implications they perceive for product planning.

Paul Manske, Ford light truck marketing plans manager:

> "...A definite swing to family outings in which the parents and children participate brings up the need for additional space in the vehicle... A sports/utility vehicle is being used increasingly in its own special form of dual-purpose application. Research for the current Bronco project showed the vehicles are used both for fairly extended travel to recreation locations and then become a factor in the recreation at the end of the trip...
>
> "4wd makes something go together that costs far more than the price of adding 4wd to a vehicle. For example, here in Michigan, you can use your cottage which cost you thousands of dollars about twice as much of the year, when you have 4wd to get into it through the winter's snow.

"The view of the new Bronco as a dual-purpose vehicle regularly used for family outings goes a long way toward explaining many of the new truck's features...Durability, traditionally a truck's top-selling feature, ranks in the top three considerations, but trails comfort and convenience... efforts to deliver on comfort and convenience put a great deal of stress on controlling potential noise and leak nuisances."[9]

William Benton, Ford Division general manager:

"More than 75 percent of all light trucks are used for personal transportation, at least part of the time... This is borne out by the number of cars traded in on trucks during the first quarter of '76: On a truck or van, about 30 percent; on a utility van, 40 percent; on a compact truck, 45 percent; and, on either a bus or van, a whopping 60 percent.

"A lot of these trades, though, are because of the multiple-vehicle growth within families...A lot of buyers trade in their second or third car on a truck or van. So, it doesn't necessarily mean that the car business will be cut, though it could happen eventually...

"At roadside stands where muscle cars gathered yesterday, today there are vans, pickups, utility vehicles, and 4-by-4s in a riot of color, with no two alike...

"Fifty percent of all vans sold in California are customized."[21]

Robert Kline, Dodge truck sales manager:

"We now aim our new trucks at surfers, beach people, bikers, and outsdoorsmen. It's clear that such buyers--who drive for fun and relaxation--are generating the pickup boom. Right now Dodge is selling more pickups for personal transportation than for work use by a 55- to 45-percent ratio.

"All the growth in pickup sales through 1980 will be in what we call 'trick trucks,' --the ones with fancy paint jobs, wide wheels, deep-lug tires, and an occasional glass vent roof. They're designed to meet the new demand.

"There's also a growing demand for four-wheel-drive pickups. The reason? Auto-company product planners say the truck is the single vehicle best equipped for the rugged demands of outdoor sports and recreation. It has a big carrying capacity, four-wheel-drive capability, and a chassis that can take more punishment than most sedans."[22]

Al Imber, Chrysler Corp. truck sales manager:

"A new travel seat option [for late arriving 1978 model Chrysler vans] can be used as a conventional forward facing unit, as a dinette with table and facing seats, as a 54-by-76-inch bed, or as a lounge unit.

"This option replaces the conventional first and second bench seats in the vehicle, and the company says conversion from one mode to the other is accomplished with a minimum of effort.

"We know that many people are buying Sportsman and Voyager wagons as a replacement for the family car and they expect a high level of interior comfort and convenience. To that end we have developed an interior trim and seating comfort package for these vehicles to rival that of a passenger car."[23]

And again:

"There's lots of talk about subcompact minivans. But, will anybody buy it? If we were to come out with one, and other vans were available, a commercial account would probably say: 'As long as the big one is available, I'll buy it.'

"If, on the other hand, it's mandated (because of fuel economy requirements or otherwise), and there's nothing else to buy, then he'll buy it...[24]

What Imber - and Chrysler's product planners - seem to be saying is that commercial buyers weigh more in their decisions on future products than the average individual. The bulk of Chrysler van sales, over 226,000 last year, went to commercial accounts, as did the bulk of 46,000 wagon sales.

Continuing on the topic of desired van size, Bernie F. Knotek, Chrysler manager of truck and equipment planning:

"Commercial-fleet buyers were approached in the middle of the gas crisis with the suggestion of their designing on a clean sheet of paper what they wanted. How big? How wide? How high? What does it have to carry?

"It came back that today's van for the commercial account is really the most fuel efficient for what they can put on the inside. They still have to do whatever their job is with the vans they have. Or, buy more vans, which means more people and more expense.

"If you describe and show pictures of a smaller van - even to individuals - people say: 'I can't put my bike, or my motorcycle, in it.' Or, 'But, I can't sleep across it.'"[24]

Finally, Gordon C. Cherry, Chrysler truck product planning manager:

> "....the custom van field was 'so personally oriented' that they did not see themselves delving deeper into it.
>
> "It does make sense, though, for us to build a vehicle like the 'ride-a-bed' (the travel seat supplied as an option in '78 wagons). That increases the van's versatility.
>
> "It's because of this versatility, or flexibility, of the van - with its flat floor and easy removable seats - that we can see two or three different kinds of vehicles emerging in the future that may generate enough volume to justify building them in our plants.
>
> "We're looking at those, and building prototypes along those lines."[24]

The views of the auto company marketers can be summed up as follows:

1. They understand the great increase in personal use of light trucks and are trying to cater to this market.

2. They see versatility as the key to this market. Versatility in outdoor recreation means four-wheel-drive.

3. However, they have not lost sight of the fact that commercial use remains their bread-and-butter determinant of design for some vehicle types, even though personal use of these same vehicles may be high.

4. The traditional value of durability is still quite important, although not paramount as it once was.

5. Although sorely tempted by the high profit margin on customizing, they realize that they cannot compete with the originality of small entrepreneurs, and they are willing to settle for a few basic design variants that help buyers to begin their personal expressions.

5.3.3 References for Section 5.3

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5. Wall Street Journal, October 10, 1977.
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12. "The Principle Readers of Pickup, Van, and 4WD Magazine," an independent research study conducted by Don Bowdren Associates.
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19. Money Magazine, November 1977.
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21. Automotive News, June 14, 1976.

22. Popular Science, March 1977.

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24. Automotive News, January 16, 1978.

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5.4 COMPARATIVE COSTS OF LIGHT TRUCKS AND CARS

5.4.1 Introduction

The marked increase in sales of light trucks in recent years raises the question of the reason for the increase. One possible reason is a change in tastes on the part of buyers. Another possibility is that light trucks have a cost advantage over comparable cars, and that buyers are responding to this difference more than in the past. This analysis concerns one portion of the latter possibility, the question whether trucks do, in fact, have a cost advantage, especially for low mileage drivers. Comparable cost figures are given for a representative pickup truck, van, and compact, intermediate, and full-sized car in one metropolitan area, Boston. This area was selected because of the ready availability of data, and because it has relatively low truck ownership. Thus, social pressures for owning a truck would be minimal.

Cars have a variety of familiar uses: travel to work, shopping trips and personal errands, recreational driving, long-distance travel, and so forth. The hypothesis concerning comparative cost is that for some users, a truck can perform these functions equally well and at lower cost.

5.4.2 Cost Results

Cost comparisons (as of late 1977) were made on the most popular vehicles with the most popular options.

The most popular vans and light trucks were determined from registration figures published by R. L. Polk & Co.[1] They are the Chevy C-10 pickup and the Ford Econoline Van E-150, both with 350 cubic inch engines. Chevrolet is consistently the best-selling make, so the Nova, Malibu, and Impala were used to get a cross-section of model sizes. The 305 cubic inch V-8 engine is the most popular in all three model sizes.

The cost of operating the vehicles was figured on a yearly average for the first three years of operation. Total yearly cost

was broken down into taxes and fees, depreciation, insurance, gasoline, and maintenance. The average cost per mile was also calculated for three different annual mileages for each vehicle. Costs are given for Boston and a Boston suburb.

Costs are given in Figure 5-1 and Tables 5-5 through 5-9. A summary picture of relative costs can be given, for example, in terms of the suburban location and an annual mileage of 5,100:

	CENTS/MILE	ANNUAL DEPRECIATION
Pickup	31.1	7.9%
Compact cars	26.3	3.9%
Intermediate cars	30.0	7.3%
Vans	37.3	7.2%
Full-sized cars	37.7	13.2%

This cost comparison shows that the pickup has a clear cost advantage over the full-sized car when annual mileage is 5,100 (for many low mileage drivers a not unreasonable figure for the first year of ownership). Thus, for people who drive less than the national average annual mileage, the pickup has a decided cost advantage over the full-sized car. This advantage diminishes as annual mileage increases. Vans and full-sized cars cost about the same, thus, vans do not enjoy a clear cost advantage over cars.

Among the various cost components, depreciation causes the greatest difference in car-truck costs. It is also the most difficult to estimate satisfactorily. The depreciation figures used above are annual averages for the first three years derived from Red Book[2] and Blue Book[3] data, and appear to be strongly affected by the inflation in new car prices in recent years, especially in the case of the compact car. If it is assumed that, in the future, depreciation of compacts is likely to be no less than the 7.9 percent of pickups, the cost per mile is increased by 3.5¢ to 29.8¢. Going further than this, the notion that trucks are more durable than cars and that cars are more subject to style depreciation in the early years can be preserved. This would entail

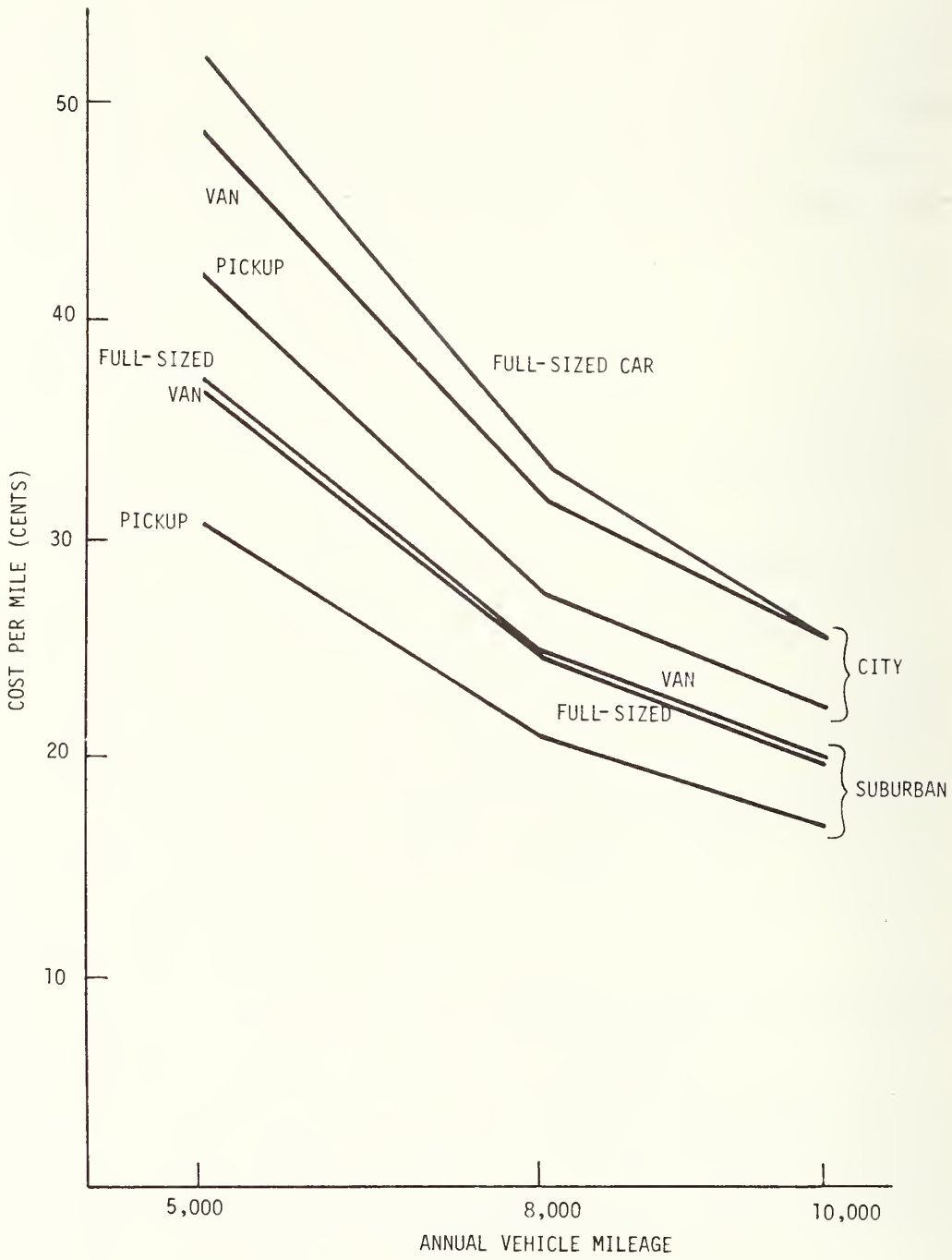


FIGURE 5-1. AVERAGE COST PER MILE DURING FIRST THREE YEARS OF OPERATION

TABLE 5-5. ANNUAL COSTS - PICKUP TRUCK

LIGHT TRUCK	PRICE	TAXES FEES *	ANNUAL MILEAGE	DEPRECIATION 7.9% *	INSURANCE *	GAS EXPENSES 15 MPG *	MAIN-TENANCE *	TOTAL COST Σ *	COST PER MILE
BOSTON (CITY)	$4600	410	5,100	363	1047	$218	105	2143	42¢
		410	8,200	363	1047	$351	119	2290	27.9¢
		410	10,600	363	1047	$454	124	2398	22.6¢
DEDHAM (SUBURB)	$4600	410	5,100	363	488	218	105	1584	31.1¢
		410	8,200	363	488	351	119	1731	21.1¢
		410	10,600	363	488	454	124	1839	17.3¢

LIGHT TRUCK

CHEVROLET 350-4BRL.

GAS COST PER GAL. 64.2¢

OPTIONS INCLUDE:
-AUTOMATIC TRANS
-8CYL. 350-4
-POWER STEERING
-AM RADIO

TABLE 5-6. ANNUAL COSTS - VAN

VAN	PRICE	TAXES + FEES *	ANNUAL MILEAGE	DEPRECIATION 7.2% *	INSURANCE *	GAS EXPENSE 15*MPG	MAIN-TENANCE *	TOTAL COST Σ *	COST PER MILE
BOSTON (CITY)	$6650	575	5,100	479	1094	218	111	2477	48.5¢
		575	8,200	479	1094	351	126	2625	32¢
		575	10,600	479	1094	454	131	2733	25.8¢
DEDHAM (SUBURB)	6650	575	5,100	479	518	15MPG 218	111	1901	37.3¢
		575	8,200	479	518	351	126	2049	25¢
		575	10,600	479	518	454	131	2157	20.3¢

VAN

FORD E-150
8 CYL - 351
OPTIONS INCLUDED
-AUTOMATIC TRANS
-8 CYL - 351
- AM RADIO
POWER STEERING
-INSULATION
-HIGH OUTPUT HEAT
-9" x 6" MIRROR
-ROLL-UP CARGO DOOR
-REAR DOOR WINDOW

GAS COST PER GALLON
64.2¢

TABLE 5-7. ANNUAL COSTS - COMPACT CAR

NOVA	PRICE	TAXES + FEES *	ANNUAL MILEAGE	DEPRECIATION * 3.9%	INSURANCE *	GAS EXPENSE * 19 MPG	MAIN-TENANCE *	TOTAL COST * Σ	COST PER MILE
BOSTON	4,451	377	5,100	174	1,233	172	99	2055	40.3¢
(CITY)		377	8,200	174	1,233	277	113	2174	26.5¢
		377	10,600	174	1,233	358	115	2257	21.3¢
DEDHAM	4,451	377	5,100	174	518	172	99	1340	26.3¢
(SUBURB)		377	8,200	174	518	277	113	1459	17.8¢
		377	10,600	174	518	358	115	1542	14.5¢

CHEVROLET
NOVA

OPTIONS:

305-ENGINE
TURBO-AUTO-TRANS
POWER STEERING
AM RADIO

GAS = 64.2c/Gal.

TABLE 5-8. ANNUAL COSTS - INTERMEDIATE CAR

MALIBU	PRICE	TAXES + FEES *	ANNUAL MILEAGE	DEPRECIATION * 7.3%	INSURANCE *	GAS EXPENSE * 20 MPG	MAIN-TENANCE *	TOTAL COST * Σ	COST PER MILE
BOSTON	4699	398	5,100	343	1,100	164	99	2104	41.3¢
(CITY)		398	8,200	343	1,100	263	113	2217	27¢
		398	10,600	343	1,100	340	115	2296	21.7¢
DEDHAM	4699	398	5,100	343	524	164	99	1528	30¢
(SUBURB)		398	8,200	343	524	263	113	1641	20¢
		398	10,600	343	524	340	115	1720	16.2¢

CHEVROLET
MALIBU

OPTIONS:
305: ENGINE
AUTO TRANS
POWER STEERING
AM RADIO
*POWER DISC BRAKES

*8 CYLINDER REQUIRED
POWER DISC BRAKES
GAS = 64.2¢/Gal.

TABLE 5-9. ANNUAL COSTS - FULL-SIZED CAR

IMPALA	PRICE	TAXES + FEES *	ANNUAL MILEAGE	DEPRECIATION * 13.2%	INSURANCE *	GAS EXPENSE * 19 MPG	MAIN-TENANCE *	TOTAL COST * Σ	COST PER MILE
BOSTON	5,045	427	5,100	666	1290	172	105	2660	52.2¢
(CITY)		427	8,200	666	1290	277	118	2778	33.9¢
		427	10,600	666	1290	358	121	2862	27¢
DEDHAM	5,045	427	5,100	666	552	172	105	1922	37.7¢
(SUBURB)		427	8,200	666	552	277	118	2040	24.9¢
		427	10,600	666	552	358	121	2124	20¢

CHEVROLET
IMPALA

STANDARD:
305: ENGINE
AUTO TRANS
POWER STEERING

OPTION:
AM RADIO
*POWER DISC BRAKES

19 MPG

GAS = 64.2¢/Gal.

a higher rate of depreciation for cars that the seven to eight percent for trucks. To make an illustrative calcualtion of what is likely the extreme, a rate of 15 percent for compacts and intermediates, a figure which has been used for cars in other studies, can be assumed. The resulting figures are:

	Cents/Mile
Pickups	31.1
Compact cars	36.0
Intermediate cars	37.1

In short, it can be said that pickups have costs roughly comparable to compacts and intermediates; where the cost advantage lies depends on what is assumed about depreciation. The costs of vans and full-sized cars are close.

Cost differences between cars and trucks are attributable to differences in component costs, in the following order, from greatest to least:

Depreciation
Taxes
Insurance
Gasoline
Maintenance.

The following analysis is based on Boston-area data. Although registration fees, and to a lesser extent insurance costs, are known to vary widely throughout the nation, the relative costs of owning a truck vs. a car are probably quite stable.

5.4.3 Calculation of Cost Components

5.4.3.1 Vehicle Price - Vehicle prices for each model were obtained by visiting automobile and light truck dealerships in the Boston Metropolitan area. Prices were requested in the same manner as any individual would when interested in purchasing a specific vehicle model. Dealers were not informed that the

information they were supplying was to be used in a research study.

The basic set of options included for all models were those found most often on cars already in the dealer's lot to be sold:

automatic transmission, eight cylinder engine, power steering, and AM radio. The same list of options, or one differing moderately, could have been generated using national data on installation rates for optional equipment. An additional set of options was included for the van in order to make it more nearly equal to the car and pickup in comfort and convenience: insulation, high output heater, 9" x 6" sideview mirror, roll-up cargo door, and rear door windows. Some people could argue that even greater comparability with cars would result from expanding the van list to include heavy-duty suspension, radial tires, and other options.

5.4.3.2 Depreciation - The depreciation figures used were calculated by following the depreciation pattern of the same model vehicle (or most similar substitute) in the past. This was done by subtracting a three-year depreciated average retail value of the vehicle from its factory advertised delivered price, and dividing by three to give an annual depreciation figure; this was than put on a percent basis. Using data for 1971 to 1977 permits a series of five such three-year calculations. These five calculations were made, and their average was computed, to arrive at the final figure for each model.

The average retail values and the factory advertised delivered prices were taken from the "Red Book, Official Used Car Valuations," and "Blue Book, Official Used Truck Valuations," published by National Market Reports, Inc.

For purposes of comparison, a seven-year annual depreciation figure was also calculated, based on the 1971 to 1977 interval. The three- and seven-year annual depreciation figures are:

	3-Year	7-Year
Pickups	7.9%	8.3%

Vans	7.2%	8.1%
Compact cars	3.9%	6.5%
Intermediate cars	7.3%	7.6%
Full-sized cars	13.2%	9.9%

Use of the longer time period results in more equal numbers.

These figures, the 3-year in particular but the 7-year as well, reflect the inflation in used car prices during recent years. This inflation has disrupted what had been the traditional pattern of higher depreciation in the early years. The extent to which it will continue, and the extent to which it will affect buyers' perceptions of comparative depreciation rates for different models, is a matter of speculation.

No simple "correction" for the inflation in used car prices is possible (even assuming one were desirable). The increase in used car prices follows, in a very rough way, the increase in new car prices, but also reflects changes in the price of fuel, emmissions regulations, changing tastes, and a variety of other factors working on supply and demand in the used car market. The correlation of the used car price index with the consumer price index is low.*

For car/truck buyers who intend to keep the vehicle for its full life regardless of the pattern of used vehicle prices, most of the pattern of used vehicle prices could be avoided; most of the complexity in calculating depreciation rates could be avoided simply by making them the inverse of the expected life of the vehicle. Unfortunately, the data on vehicle life, when combined with what is known about lifetime mileage of vehicles, yield completely paradoxical results; thus, it has not been used.

A further complication may be significant. The data on used truck prices reflect trucks that were used largely in traditional ways. The concern in this test, however, is with how trucks

*See Section 7 on Used Car Demand.

would depreciate when used more as cars are now used. Would trucks depreciate more in the manner of cars if they were used more like cars?

In short, the approach used is that indicated in the summary section: estimate bounds on the range of rates in depreciation, and more particularly on the range of variation in the ratio of car/truck depreciation rates.

5.4.3.3 Taxes and Fees - Taxes and fees for each model are the sum of three major charges that are mandatory when buying a new or used vehicle, the sales tax, excise tax, and registration fees.

The sales tax in the state of Massachusetts is 5 percent of the purchase price of the vehicle, and is paid once, at the time of purchase.

The excise tax is a charge paid annually at a rate of $66 per $1000 of purchase price. This charge decreases each year as the vehicle depreciates.

Registration fees are paid annually on vehicles that must be registered commercially, at a cost of $5 per 1,000 lbs. of gross vehicle weight and $5 for any fraction thereof, plus a $5 change of title fee. Vehicles registered for personal use pay a $14 registration fee every two years, plus the $5 change of title fee.

Passenger automobiles can be registered as a personal vehicle along with vans with windows all around and a seat behind the driver. Light trucks and cargo vans (without optional windows and backseat) must be registered commercially.

Vehicles with commercial plates cannot be driven on parkways or other roads designated pleasure vehicles only.

The figure for each model used in this study is the total of three years of taxes and fees divided by three to give an average annual amount.

5.4.3.4 Insurance - Insurance costs were obtained by calling four insurance companies and asking for the price of coverage on the

specific vehicle models concerned. The level of coverage specified was personal liability, $100,000/$300,000; property damage, $10,000; medical payments, $1,000; uninsured motorist; comprehensive fire and theft, and collision, $250 deductible. (The ALA advises motorists to buy coverage equal to or approaching these amounts.)

The cost figure used was the lowest price quoted in each case. For cars, the range in figures quoted was approximately $100, except in the case of the Malibu, in Boston, where the range was $200. For trucks the range was greater:

Chevy C-10 Pickup

Boston	Suburb
$1047	$488
1132	498
1167	540
1464	550

Ford Econoline E-150 Van

Boston	Suburb
$1094	$518
1424	608
1432	660
1968	702

The highest truck figure for Boston is used by a company which wishes to avoid writing Boston business, and, so, can reasonably be excluded from our calculation on the grounds that few, if any, insurance buyers will purchase at this price. With this exclusion, the range of prices for trucks is much the same as for cars, except in the case of vans insured in Boston. In other words, use of an average figure rather than the lowest figure quoted would give us largely the same comparative cost for cars and trucks. Averages would be more accurate in the case of the van insured in Boston, but data are lacking on how to weigh the various figures quoted.

5.4.3.5 Fuel - Total annual gas expenditure was computed by dividing the specific model's average miles per gallon into the annual mileage and then multiplying this figure by the average cost of gasoline per gallon.

The average miles per gallon for each vehicle was found in the "1978 Gas Mileage Guide"[4]: pickup and van, 15 mpg; compact and full-sized car, 19 mpg; intermediate, 20 mpg. The cost of gasoline per gallon, 64.2¢, is an average price for the Boston Metropolitan area's lead-free gasoline. Lead-free gas is required in all models used in ths study.

5.4.3.6 Maintenance - The items requiring maintenance work and the frequency of such work were determined from the owner's manual for each model used in the study. The items included changing engine oil, oil filter, chassis lubrication, spark plugs, coolant, and one set of tires. In addition, a $96 miscellaneous repair fund, the same for all vehicles, was included; this figure was taken from the ALA brochure, "What It Costs To Run A Car."[5]

The cost of each maintenance job was estimated by making inquiry at representative Boston area dealer service departments. Total repair costs were calculated for a period of three years and then divided by three to give an annual average.

5.4.4 Further Comments

Trucks are usually, in varying degrees, less comfortable than cars in such comfort dimensions as temperature control, enclosed seating area, and insulation from noise. In making the car-truck cost comparison, it is desirable to approximate, as much as is reasonably practicable, the case in which the truck is equally comfortable; this has been done by including in the price of the van an appropriate set of options. If the truck is equally comfortable and costs less, it seems a reasonable speculation that buyers might shift to the truck because of the cost difference.

In a different case, if the truck is significantly less comfortable, the buyer may still choose it, for cost reasons, if it has a substantially lower cost than the car. However, the truck will also normally have advantages over the car in terms of cargo

space and the like. Hence, in the absence of particular knowledge of buyers' trade-offs among discomfort, cost, and truck advantages, it cannot be argued that a buyer's shift to the truck would be caused by the lower cost rather than an increased preference for the truck's particular advantages.

Pickup trucks more nearly approach cars in comfort than do vans (without a set of comfort options), but they are much different with respect to seating capacity. In the normal case, a pickup seats, at most, three (an elongated cab option is infrequently used). This makes the pickup less than a perfect substitute for a car in the case of large families. Here, rather than pricing an elongated cab option, the more natural approach is to divide the car-using population into large and small families, and note that our comparison applies, prima facie, only to the latter.

It is useful to set out some of the cases schematically, indicating by "comfort" all those characteristics in which cars are normally superior, and by "cargo" all those in which trucks are normally superior.

Case 1) Comfort: Same
Cargo: Same
Cost: Truck lower.

This is a clear case of truck's imaginary superiority. Even if the truck can be made as comfortable, the car cannot have as much cargo space.

Case 1a) Comfort: Car better, but this difference is not significant to the buyer

Cargo: Truck better, but this difference is not significant to the buyer

Cost: Truck lower.

This is another clear case of the truck's superiority. However, it is a case which will apply to few buyers in that most will put some positive value on the added cargo space.

Case 1b) Comfort: Same or no significant difference

Cargo: Truck better and this difference is significant to buyers

Cost: Truck lower.

This is a more realistic case. Here, we cannot attribute a switch to trucks solely to the lower cost, but, nevertheless, the lower cost would, by itself, be sufficient to cause the switch.

Case 2) Comfort: Same or insignificant differences

Cargo: Truck slightly better

Cost: Same.

This is another realistic case, of interest as a reminder that when costs are the same, only a slight change in tastes may be needed to cause a switch to trucks. In other words, if costs are pretty much the same, we may get a massive change from car to truck purchases as the result of only a small change in tastes.

In passing, it can be noted that a cost superiority for trucks (as in case 1) does not, per se, explain an increase in truck purchases away from cars, if the same cost difference existed in the past. At least for the five models chosen for comparison, cost differences favored trucks more in the past than they do now. The inflation from 1971 to 1977 for each has been:

Vans	50%
Pickups	50%
Compact cars	48%
Intermediate cars	46%
Full-sized cars	34%

Thus, if cost differences rather than a change in tastes is to explain the switch (or a part of it), it must be assumed that buyers have become better informed about costs, that it has become socially more acceptable to own a truck then it was previously, that the buyer has had a decrease in real income and, thus, puts less weight on the disadvantages of a truck, or some other such argument. All of these seem reasonable possibilities for a certain number of people. Moreover, it may be that those increased truck sales which are due to a change in tastes (or to a positive income elasticity of demand

for trucks as recreational vehicles)* have led to the greater information about trucks or greater social acceptability which would make a switch to trucks on a purely cost basis a choice open to another group of buyers.

5.4.5 References for Section 5.4

1. Registration Figures from R. L. Polk & Co.
2. Red Book "Official Used Car Valuations," National Market Report, Inc.
3. Blue Book "Official Used Truck Valuations," National Market Report, Inc.
4. "1978 Gas Mileage Guide," First Edition, September 1977, Environmental Protection Agency.
5. "What It Costs to Run a Car," ALA Brochure.
6. Consumer Reports Data.

*Paradoxically, but quite possibly, some buyers might be switching to trucks because their incomes are going down, and others because their incomes are going up. For the one, a truck could be a means to save money; for the other, it could be a part of a pattern of recreational expenditure in which total recreation plus travel expenses are rising.

5.5 LIGHT TRUCK OWNERSHIP

The percentage of families owning at least one light truck increased 33 percent between 1970 and 1977, with uncharacteristically faster growth among higher income and occupation groups and within the highest population density areas. In 1970, the family income quintile with the highest percentage of truck ownership was the middle income quintile with 25 percent owning at least one truck (see Table 5-10). By 1977, truck ownership had increased among the highest income familes such that the top half of the income quintiles had similar percentages owning one or more trucks. Consequently, light truck ownership has become as high in the higher income groups as in the middle income groups.

TABLE 5-10. TRUCK OWNERSHIP BY FAMILY INCOME QUINTILES (1970 and 1977)

	Families with one or more trucks (%)		
	1977	1970	% Change
All Families	24%	18%	33%
Family Income Quintiles			
Lowest 5th.	14	11	27
2nd 5th.	23	18	28
3rd 5th.	29	25	16
4th 5th.	32	20	60
Highest 5th.	32	19	68

Source: Survey of Consumer Finances, Institute for Social Research, University of Michigan, 1977.

Professional (+78 percent), managerial (+43 percent), and clerical (+50 percent) workers headed families that had the highest rates of truck ownership growth among the occupational groups between 1970 and 1977. Farmers (-24 percent) and self-employed business persons (-11 percent) both experienced relative losses in the percentages owning one or more trucks (see Table 5-11). Thus, trucks have been losing popularity among occupations that traditionally used trucks in their work, and trucks have gained popularity among occupations that traditionally had not used trucks in their jobs. This finding gives credence to the proposition that truck usage for non-work purposes is increasing.

TABLE 5-11. TRUCK OWNERSHIP BY OCCUPATION OF HEAD OF HOUSEHOLD (1970 and 1977)

	Families with one or more trucks (%)		
	1977	1970	% Change
Occupation of Head of Household			
Professional	16%	9%	78%
Managerial	20	14	43
Self-Employed Business	42	47	-11
Clerical	15	10	50
Craftsmen & Foremen	37	30	23
Operatives	26	26	0
Labor & Service	18	17	6
Farmers	61	80	-24
Miscellaneous	9	9	0
All Families	24	18	33

Source: Survey of Consumer Finances, Institute for Social Research, University of Michigan, 1977.

Truck ownership continues to increase as density declines, with outlying areas of SMSAs having four times the truck ownership rate of the densely settled central cities of the 12 largest SMSAs in 1977 (see Table 5-12). The central cities' growth rates of truck ownership, though, have been high. Between 1970 and 1977,

the percentage of families with trucks in the central cities of the 12 largest SMSAs and in the central cities of the other SMSAs increased, respectively, 175 percent and 50 percent. Areas adjacent to metro areas and those farthest from the highest density areas only had increases of 28 percent and 34 percent,respectively. Truck ownership has consequently increased faster in the high density cores.

TABLE 5-12. TRUCK OWNERSHIP BY RESIDENTIAL BELT (1970 and 1977)

	Families with one or more trucks (%)		
	1977	1970	% Change
Residential Belt			
Central Cities of 12 Largest SMSAs	11%	4%	175%
Suburbs of 12 Largest SMSAs	12	10	20
Central Cities of Other SMSAs	16	11	45
Suburbs of Other SMSAs	24	16	50
Adjacent Areas of SMSAs	32	25	28
Outlying Areas of SMSAs	43	32	34
All Families	24	18	33

Source: Survey of Consumer Finances, Institute for Social Research, University of Michigan, 1977.

The above findings indicate that trucks have gained in popularity more among the higher income and occupational groups that traditionally had little interest in trucks than in groups where trucks had been more common. This growth in popularity indicates that trucks have become more socially acceptable to higher status populations. Since the 1977 census data are not yet available (June 1979), the best statistical evidence, besides opinions (See Section 5.3), is truck buyer surveys.

Results of such a new truck buyer survey by Rogers National Research, Inc. are shown in Tables 5-13 through 5-15. These

TABLE 5-13. PRIMARY USE OF 1977 LIGHT TRUCKS AND VANS PURCHASED BY EARLY MODEL BUYERS

Type of Vehicle	Business (%)	Personal Use (%)	Both about Equal (%)
Pickup Trucks	22	54	24
Sport/Utility	7	70	23
Suburbans	16	60	25
Vans	24	59	17
Passenger Vans	14	67	19
Compact Pickups	14	65	21

Source: TSC Summary of Disaggregate Data from Rogers National Research, Inc.; Disaggregate Data are Proprietary

TABLE 5-14. EARLY MODEL BUYERS OF 1977 LIGHT TRUCKS AND VANS USED AS TRANSPORTATION TO AND FROM WORK

	Some or All of The Time (%)	Never (%)
Pickups	90	10
Sport/Utility	91	9
Suburbans	80	20
Vans	90	10
Passenger Vans	78	22
Compact Pickups	91	9

Source: TSC Summary of Disaggregate Data from Rogers National Research, Inc.; Disaggregate Data are Proprietary

TABLE 5-15. EARLY MODEL BUYERS OF 1977 LIGHT TRUCKS AND VANS USED FOR ON THE JOB WORK

	Some or All of the Time (%)	Never (%)
Pickups	61	39
Sport/Utility	39	61
Suburbans	49	51
Vans	48	52
Passenger Vans	40	60
Compact Pickups	47	53

Source: TSC Summary of Disaggregate Data from Rogers National Research, Inc.; Disaggregate Data are Proprietary

results suggest that the personal use growth for standard sized pickup trucks may, at best, be minor. The 1972 census permitted only one major use, and 59 percent listed personal transportation. On the Buyer Survey, 54 percent listed personal transportation as their primary use and 24 percent said they use their pickups about equally for personal and business use. However, 65 percent of the compact pickup buyers indicated that they use their vehicles primarily for personal transportation; in addition, 21 percent indicate equal personal and business use. Thus, even if personal use of standard sized pickups has not increased, the increased personal use of compact pickups should have resulted in an increased personal use of all pickups. Compact pickups account for around 15 percent of all pickup sales.

There is a clear cut increase in the use of vans for personal transportation. The 1972 census survey indicates that about 30 percent of the vans are used for personal transportation. The Model Year 1977 Buyer Survey suggests about 60 percent. Though these vehicles are used primarily for personal transportation, over 40 percent of all van buyers use their vehicles at least some times for "on the job work." Among standard sized pickup buyers, about 60 percent use their vehicles at least some time for "on the job work."

It is clear that there is an extensive use of light trucks and vans in job related functions. However, to what extent these functions require a vehicle of van or pickup dimensions is unknown.

5.6 TRENDS IN LIGHT TRUCK SALES IN THE 1970's

Light truck sales have grown since 1971, when they accounted for 14 percent of the total new motor vehicle sales, to the point where they accounted for over 24 percent of the total vehicle sales by 1978 (Table 5-16). The steady growth in total light truck sales during the 1970's is contrasted by the dramatic growth in the share of Class II light truck sales that occurred in response to EPA emissions standards on Model year 1975 to 1978 vehicles up to 6000 pounds GVW.

Before the EPA requirements were mandated, prior to the 1975 Model Year, the share of new light trucks registered as Class II (the percent of all light trucks 0-1000 pounds GVW that were between 6001 and 10000 pounds GVW) was consistently between 29 percent and 32 percent. The Class II share of light trucks jumped over 10 percentage points between 1974 and 1975, and increased to 55 percent by 1977 (see Table 5-16). The upsizing of light truck purchases which occurred to response to emissions controls indicate that many buyers bought the higher weight carrying truck to avoid the catalytic converter that the regulation produced on Class I trucks (0-6000 pounds GVW).

Recent data indicate that the upsizing of light truck purchases that had begun in 1975 has begun to subside with the added coverage of EPA emissions controls on vehicles up to 8499 pounds GVW for 1979 model year vehicles. Class II shares of light truck sales grew steadily through January-August 1978 to the high of 59 percent, but began to fall to 53 percent by January-April 1979 after the emissions controls were added to the bulk of Class II trucks (Table 5-16).

The share of light trucks purchased in the total motor vehicle market continues to hover around the 24 percent annual figure. The recent gasoline supply problem, though, is expected to hurt light truck sales more than subcompact and compact sales. Light truck shares, therefore, are expected to fall as the gasoline supply problem heightens.

TABLE 5-16. TOTAL LIGHT TRUCK (0-10000 LBS, GVW) AND CLASS II (6001-10000 LBS, GVW) LIGHT TRUCK SALES TRENDS (1971 - APRIL 1979)

	1971	1972	1973	1974	1975	1976	1977	1978	Jan-Aug 1977	Sept-Dec. 1977	Jan-Aug 1978	Sept-Dec 1978	Jan-Apr 1979
TOTAL CLASS II SALES	487,633	598,813	758,236	696,248	951,710	1,400,947	1,802,692	2,139,644	1,182,729	619,963	1,498,504	1,641,140	602,867
TOTAL LIGHT TRUCK SALES	1,672,374	2,096,443	2,512,490	2,162,834	2,052,952	2,719,439	3,296,553	3,668,218	2,221,110	1,075,443	2,537,770	1,130,448	1,140,680
TOTAL MOTOR VEHICLE SALES	11,944,397	13,031,631	14,110,993	11,010,654	10,678,544	12,451,333	14,479,965	14,983,878	10,308,852	6,596,378	10,306,126	4,677,752	4,869,022
CLASS II SALES AS % OF TOTAL LIGHT TRUCK SALES	29.2	28.6	30.2	32.2	46.4	51.5	54.7	58.3	53.2	57.6	59.0	56.7	52.9
TOTAL LIGHT TRUCK SALES AS % OF TOTAL MV SALES	14.0	16.1	17.8	19.6	19.2	21.8	22.8	24.5	28.2	16.3	24.6	24.2	23.4

Source: Ward's Automotive Yearbooks, 1971-1979, and Automotive News, various issues.

6. RECREATIONAL VEHICLE DEMAND*

6.1 INTRODUCTION

The objective of this section is to present the trends in recreational vehicle (RV) shipments, and to relate these to the availability of gasoline and to federal regulations with respect to emissions and fuel economy. Data from the Recreational Vehicle Industry Association (RVIA) on trends in RV sales by type of RV are examined.

It should be noted that most of these vehicles are not subject to fuel eocnomy standards. The data included in this section are only intended to increase the readers's understanding of the personal use aspects of light trucks.

6.2 MAJOR FINDINGS

- Total recreational vehicle sales rose sharply in the late 1960's and early 1970's. RV sales peaked in 1972, and were already declining prior to the Arab-Israeli war of October, 1973.
- The most expensive RVs, motor homes, recovered after the recession of 1974-75 to sales levels above those prior to the Arab Oil Embargo; however, sales declined in 1978.
- The weakness in RV sales since 1972 appears to be associated with the rather sluggish growth, since then, of many outdoor recreational activities.

6.3 THE TYPES OF RECREATIONAL VEHICLES

The industry distinguishes four types of Recreational Vehicles:

*This section covers recreational vehicle demand between 1967 and 1978. The primary research for this section was performed in May, 1979.

Travel Trailers,
Truck Campers,
Fold-Down Camping Trailers, and
Motor Homes.

6.3.1 Travel Trailer

These trailers range from 12 to 35 feet in length (including the hitch) and are less than eight feet wide. The trailers are typically equipped with air conditioning, cooking, heating, and bathing and toilet facilities. There are two types of travel trailers: "conventional" and "fifth wheel." "Conventional" travel trailers can be towed by auto, van, or pickup truck; "fifth wheel" are designed to be towed by a pickup truck with a fifth wheel hitch mounted in the truck bed.

6.3.2 Truck Camper

Truck campers (6 to 12 feet long) are secured to a pickup truck bed with special bolt-on devices. The pickup trucks used for these units typically are equipped with such features as heavier suspensions, power steering and brakes, and automatic transmissions.

6.3.3 Fold-Down Camping Trailer

These trailers have plastic and canvas folding walls allowing the unit to keep a low touring profile.

6.3.4 Motor Home

These are self powered recreational vehicles that provide self-contained living facilities for both camping and highway use.

6.4 RECREATIONAL VEHICLE SHIPMENTS

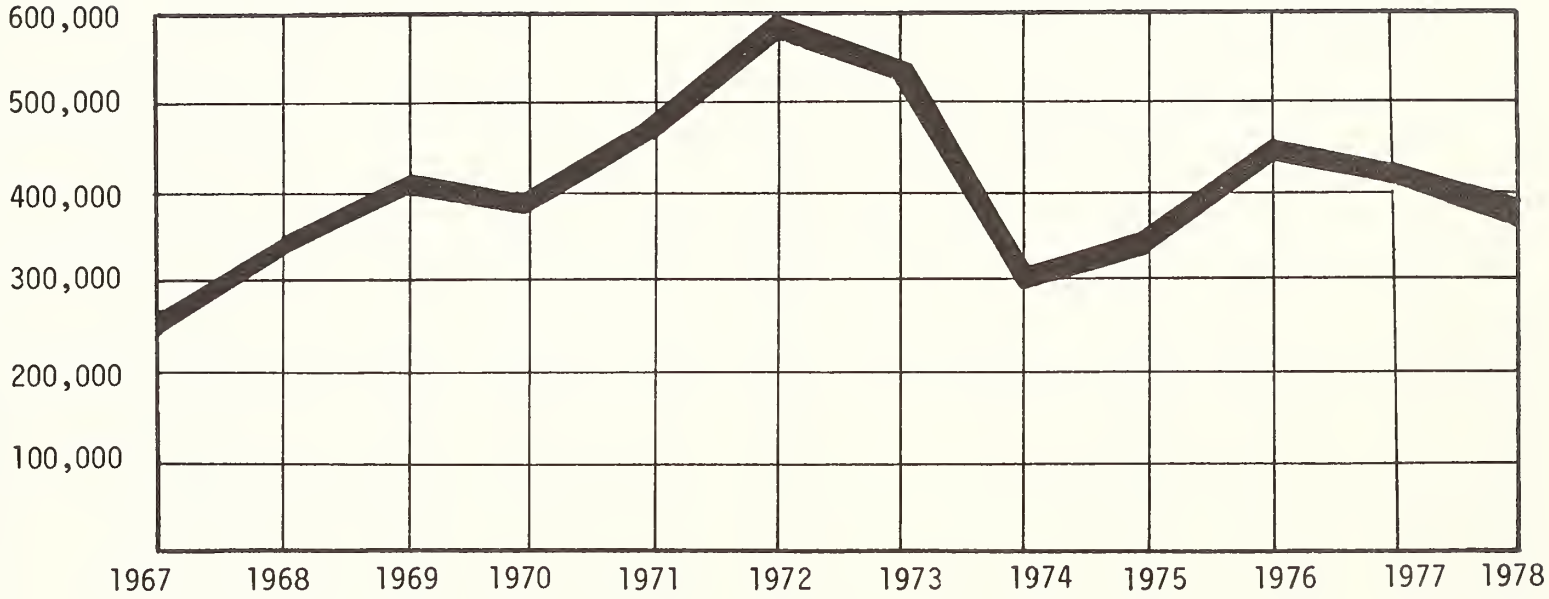
The sale of recreational vehicles rose sharply during the late 1960's and early 1970's. (See Table 6-1 and Figure 6-1). Sales peaked in 1972 when RV shipments reached 583,000 units.

TABLE 6-1. RV SHIPMENT TRENDS

YEAR	TOTAL SHIPMENTS	TRAVEL TRAILERS	TRUCK CAMPERS	FOLD-DOWN CAMPING TRAILERS	MOTOR HOMES*	% INCREASE ALL TYPES
1978	389,900	159,800	24,700	48,200	157,200	- 5.8
1977	413,900	167,900	31,900	53,900	160,200	- 6.2
1976	441,100	189,700	42,000	53,300	156,100	+29.9
1975	339,600	150,600	44,300	48,100	96,600	+14.8
1974	295,800	126,300	45,400	55,200	68,900	-44.1
1973	528,800	212,300	89,800	97,700	129,000	- 9.3
1972	582,900	250,800	105,100	105,100	116,800	+29.2
1971	451,000	190,800	107,200	95,800	57,200	+18.6
1970	380,300	138,000	95,900	116,100	30,300	- 5.1
1969	400,600	144,000	92,500	141,000	23,100	+20.3
1968	333,100	115,200	79,500	125,200	13,200	+36.3
1967	244,430	94,500	61,600	79,280	9,050	

* Excludes Type B-2 panel-type trucks lacking plumbing, heating, and 115-volt electrical system.

Source: References 1, 2, 3.



Source: References 1,2,3.

FIGURE 6-1. TOTAL RV SHIPMENTS

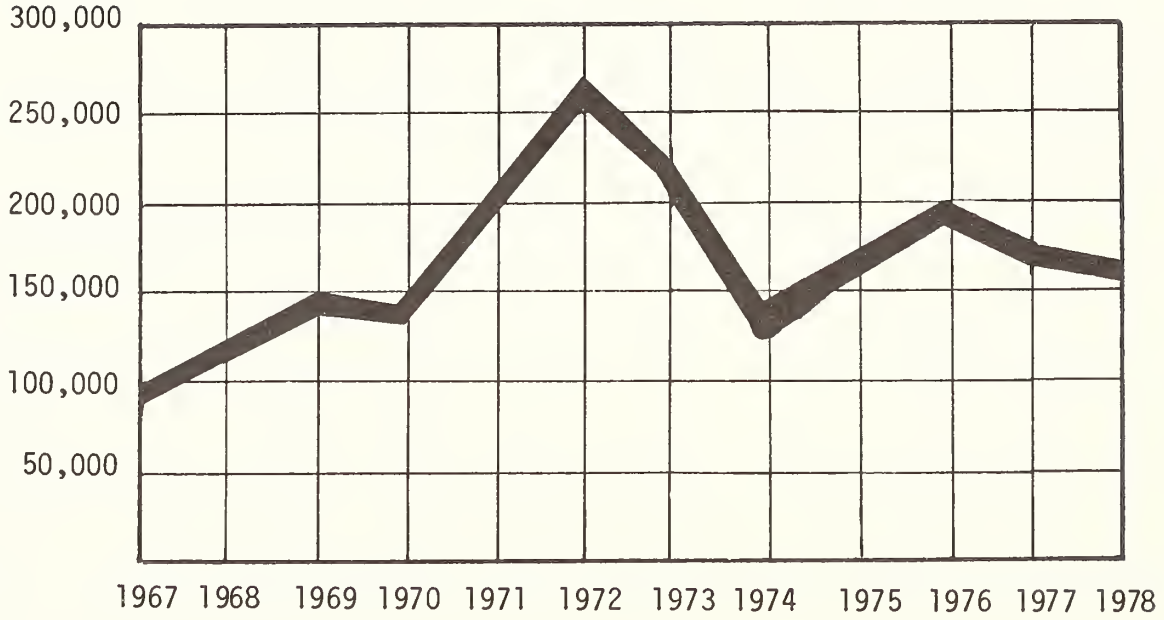
Shipments declined to a low of 296,000 units in 1974. After that, they recovered through 1976, when 441,000 units were shipped. Shipments in 1978 declined to 390,000 units. Although the depressed RV shipments may have been exacerbated by rising gas prices and fuel economy regulations, the decline was not caused by these factors. The decline began earlier. During the first nine months of 1973, i.e., prior to the Arab-Israeli War in October, 1973 which triggered the Arab Oil embargo, RV shipments were down. Total shipments for the first nine months of 1973 were 467,200 units compared to the first nine months of 1972 when the industry shipped 475,800 units. This decline in RVs corresponds to the rather sluggish growth, since 1973, of revenues from many outdoor recreational activities, including sales of outboard motor boats, federal duck stamps, fishing licenses, etc.[1]

6.4.1 Travel Trailer Demand

The demand for travel trailers peaked in 1972, with 251,000 shipments, and declined to half that level by 1974 (see Figure 6-2 and Table 6-1). In 1975 and 1976, only about half of these losses were recovered; sales again declined in 1977 and 1978, when 160,000 units were shipped. During the first nine months of 1973, travel trailer shipments declined by 10 percent from the same 1972 nine-month period. This was the sharpest decline among all types of RVs. The decline appears to be unrelated to any federal regulation. If there had been a negative anticipation of the MY 1974 EPA standards, one would have expected a rise in 1973 travel trailer shipments, not a decline.

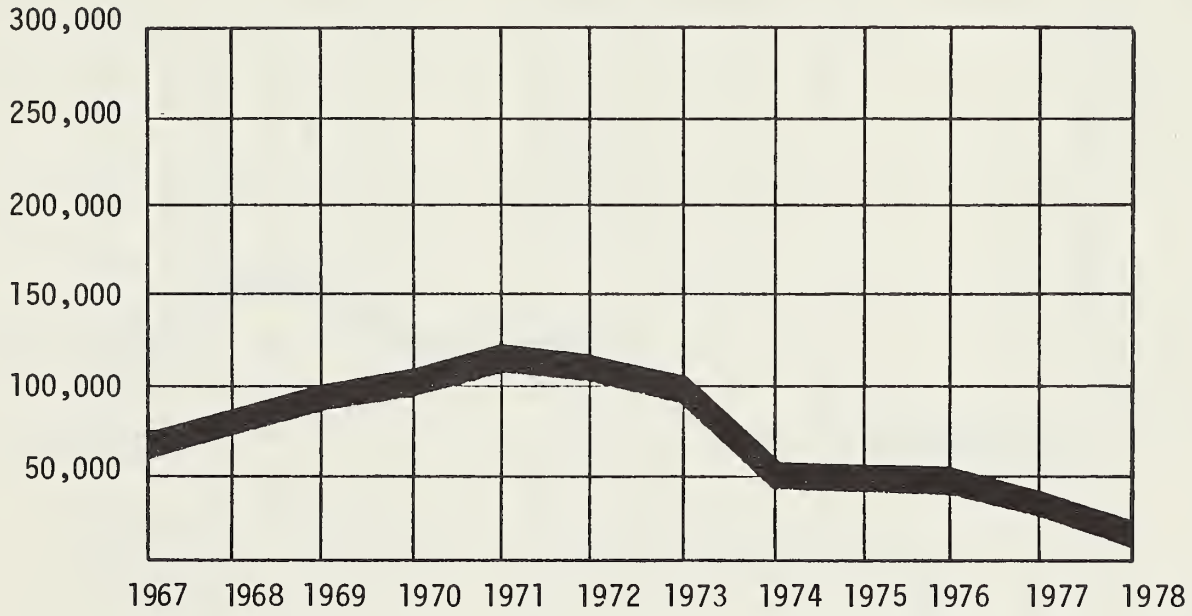
6.4.2 Truck Camper Demand

Demand for truck campers peaked in 1971 when 107,000 units were shipped (See Figure 6-3 and Table 6-1). Shipments declined from 1972 through 1977, when 32,000 units were shipped. In 1978, an all-time low of less than 25,000 units was shipped.



Source: References 1,2,3.

FIGURE 6-2. TRAVEL TRAILER SHIPMENTS



Source: References 1,2,3.

FIGURE 6-3. TRUCK CAMPER SHIPMENTS

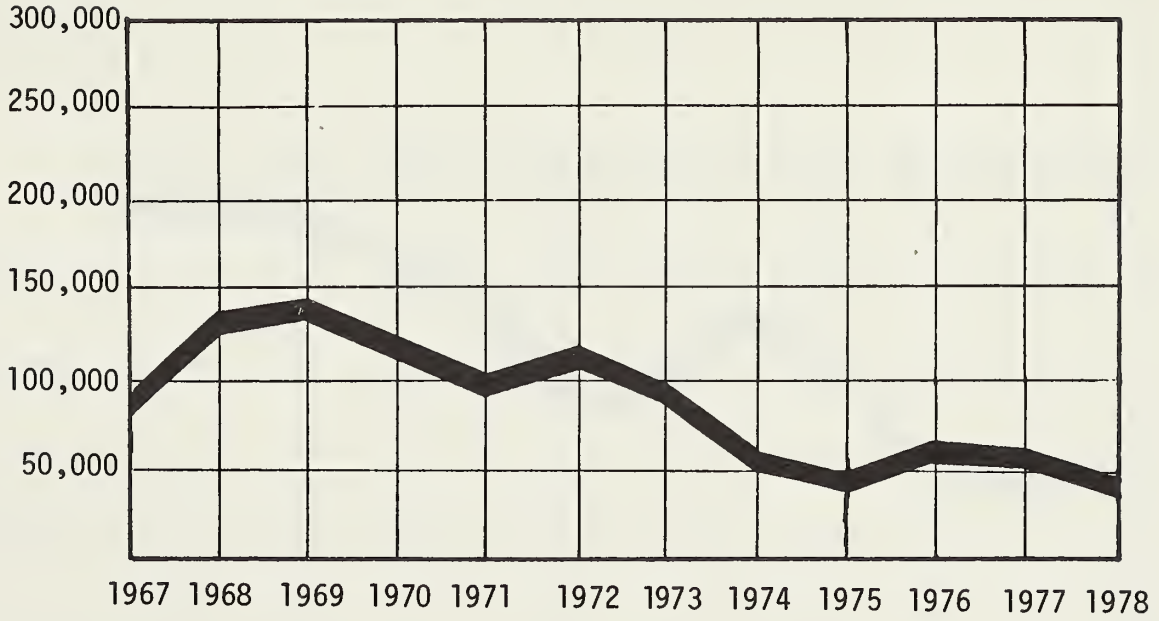
6.4.3 Fold-Down Camping Trailer Demand

Shipments of fold-down camping trailers peaked in 1969 and have declined since then with only minor recoveries in 1972, 1976, and 1977 (See Figure 6-4 and Table 6-1). Fold-down camping trailers are the least expensive of the RVs. At the camp site, they involve the same level of "roughing-it" as a tent, although they have shorter set up and break up times. The competition from the more convenient RVs and the less expensive tents may be the major factor for the decline in fold-down camping trailers.

6.4.4 Motor Home Demand

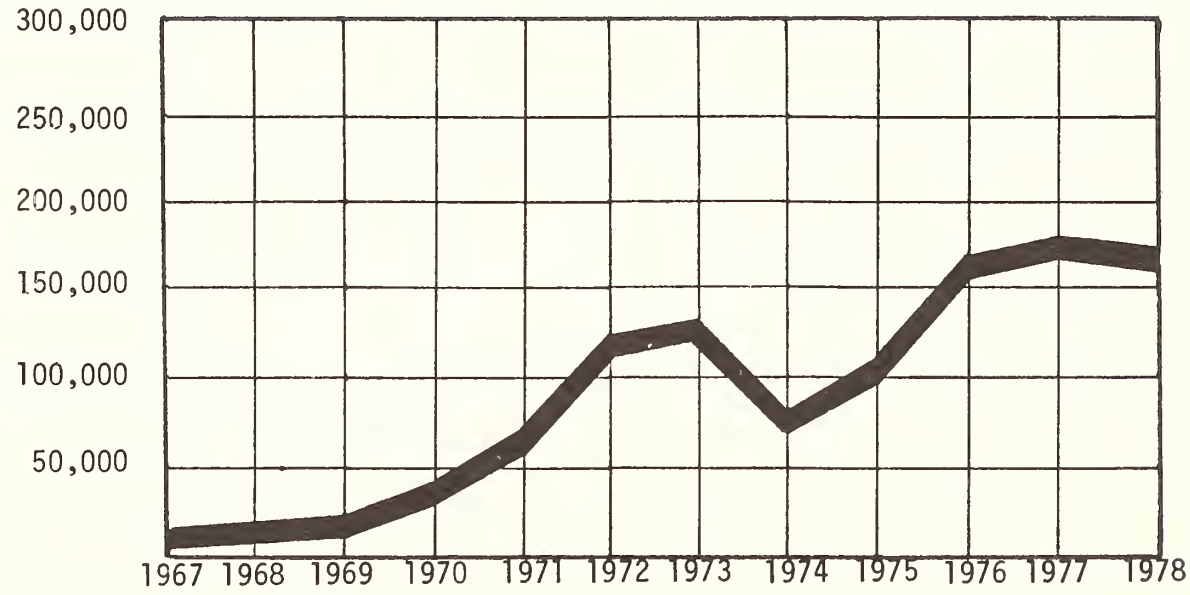
The shipments of motor homes increased from 9,000 units in 1967 to 129,000 units in 1973 (see Figure 6-5 and Table 6-1). The following year, sales declined by 44 percent to 69,000 units. They then recovered through 1977, but declined again in 1978. In 1977, 160,000 units were shipped, or about a quarter more than in 1973. Since motor homes are the most expensive products of the industry, the total retail value of RV shipments has increased steadily since the mid 1960's, except for 1974 and 1978 (see Figures 6-6 and 6-7).

There is little doubt that the decline in motor home sales in 1974 can be associated with the Arab Oil embargo and the 1974-75 recession. The 1978 decline in motor home sales is, however, less easily explained. The timing of this decline suggests that neither fuel efficiency nor emission regulations is the cause. It appears likely that the decline is closely associated with other new recreational priorities which make motor home travel a less desirable alternative.



Source: References 1,2,3.

FIGURE 6-4. FOLD-DOWN CAMPING TRAILER SHIPMENTS



Source: References 1,2,3.

*Excludes Type B-2 (see Table 6-1).

FIGURE 6-5. MOTOR HOME SHIPMENTS*

6.5 REFERENCES FOR SECTION 6

1. U.S. Bureau of the Census, "Statistical Abstract of the United States: 1978," 99th Edition, Washington, DC, 1978.

2. "Facts and Trends," Recreational Vehicle Industry Association, 1977.

3. "Data Book Issue, 1979 Market," Automotive News, April 25, 1979.

7. USED CAR DEMAND *

7.1 INTRODUCTION

The impacts of the Automotive Fuel Economy Regulations Program (AFER) on the used car market have been mainly indirect. The fuel efficient vehicles mandated by AFER are still too new to represent an important or major share of the cars available in the used car market. However, since the used and new car markets are integrally related to one another, changes in the new car market impact the used car market. If new car sales are brisk, there are many trade-ins, and used car prices tend to fall. If new car sales are poor, the supply of trade-ins is limited, and used car prices begin to climb. Often, high used car prices make it more economical to repair a car and use it rather than to trade it in or scrap it. With high used car prices, scrappage rates tend to go down, and people tend to hold onto their cars longer.

Under the aegis of the nation's concern with fuel efficiency, new motor vehicle designs have changed and with it the features that are emphasized in new car advertisements. Now, additional factors are considered desirable in a new car. These changes in new car tastes tend to reflect themselves in the used car market. Some people buy used cars because they do not like the new cars. This tends to lower scrappage rates and increase vehicle life. Still, most used car buyers would prefer to buy new cars if they could afford them. This preference tends to drive up the prices of the used cars that resemble the most popular new cars, while the used cars that are most different from the popular new cars tend to command lower prices. Since AFER, one can observe both longer vehicle lives and major changes in depreciation rates and the relative prices of used cars.

This section deals with the changes in the used car market since the passage of AFER. It especially deals with the size of

*This section covers the used car market between 1971 and 1978. The primary research for this section was performed in February, 1979.

the used car market, the trends in used car prices in general and relative to market segment, and the changes in vehicle scrappage rates. These sections are followed by a discussion of some possible future impacts of AFER on the used car market and the consumers who rely on this market for their mobility.

7.2 MAJOR FINDINGS

o Used cars and used light trucks account for slightly more than half, 52 percent, of all vehicles owned or used by private households. The market consists of roughly 60 to 65 million vehicles with 19 to 20 million annual purchases.

o Approximately 30 percent of all households that own passenger cars own only passenger cars bought used. Among households with an income of less than $7,000, over half own only cars bought used.

o Since the passage of AFER, used car prices have risen at a faster rate than the general rate of inflation as well as the inflation rates for new cars and gasoline. A very sharp rise in used car prices began in the fall of 1974, over one year before the passage of AFER, and continued through the spring of 1977. During this period, used car prices increased by about 40 percent. Then, a major correction of about 15 percent in used car prices occurred which lasted through the winter of 1977-78. Since then, used car prices have again risen sharply, recovering more than all the ground they lost in 1977.

o Relatively speaking, used car prices for full-sized cars have been weak, while those for the intermediates, compacts, and subcompacts have been strong. For at least the past year, intermediates, compact sedans, and station wagons, which are four years old and older, have commanded higher prices than full-sized cars and station wagons of the same make, if they are equally equipped and in the same condition.

o Since the energy crisis of 1973, there has been a general increase in the average age at which passenger cars are scrapped. However, with the recovery from the 1974-75 recession, there was

a reduction in the average age at scrappage. Relatively speaking, the sharpest decline in the scrappage rate since 1973 has been in 11 year old and older passenger cars; these cars have had the smallest increase in scrappage since the 1974-75 recession.

o The motor vehicle is still a growing element in the U.S. society. Available ownership data indicate that, at least through 1977, the number of passenger cars per U.S. household increased every year, while the percent of households without cars declined. However, with the relatively low 1977-78 automobile sales, a further expansion of the passenger cars per household ratio appears doubtful, unless unusally few cars are scrapped. Still, with the strong light truck sales, the total motor vehicle per household ratio should have expanded.

o It is projected that the long term impacts of AFER on used car sales will depend on the durability, reliability, maintainability, and catastrophic failure rate of the fuel efficient vehicles. The more durable the AFER cars, the longer they will last in the registered fleet and the lower their depreciation rate will be. The proportion of used car purchases to new car purchases is a function of the cars' reliability. If the AFER cars are highly reliable and depreciate in their reliability only slowly with age and/or mileage, the used car market relative to the new car market will be smaller than if the cars lose their reliability in a short period of time or after relatively few miles. Finally, maintainability and the catastrophic failure rate, i.e., the chance that a car incurs a major repair, affect the cost of the car that delivers "minimum transportation." If the AFER cars have good maintainability and a low catastrophic failure rate, the price of a car that delivers "minimum transportation" will be relatively low. If not, it will be higher. In general, the price of the "minimum transportation" car has far outpaced the price of nearly everything else by increasing roughly tenfold since the early 1940's.

7.3 THE SIZE OF THE USED CAR MARKET

Used cars and used light trucks account for slightly more than half, or 52 percent, of all vehicles owned or used by private households. These are the results of a recent, June 1978, survey sponsored by the National Science Foundation.[1*] An expansion of these survey results suggests that there are between 60 and 65 million used vehicles owned or operated by American households.

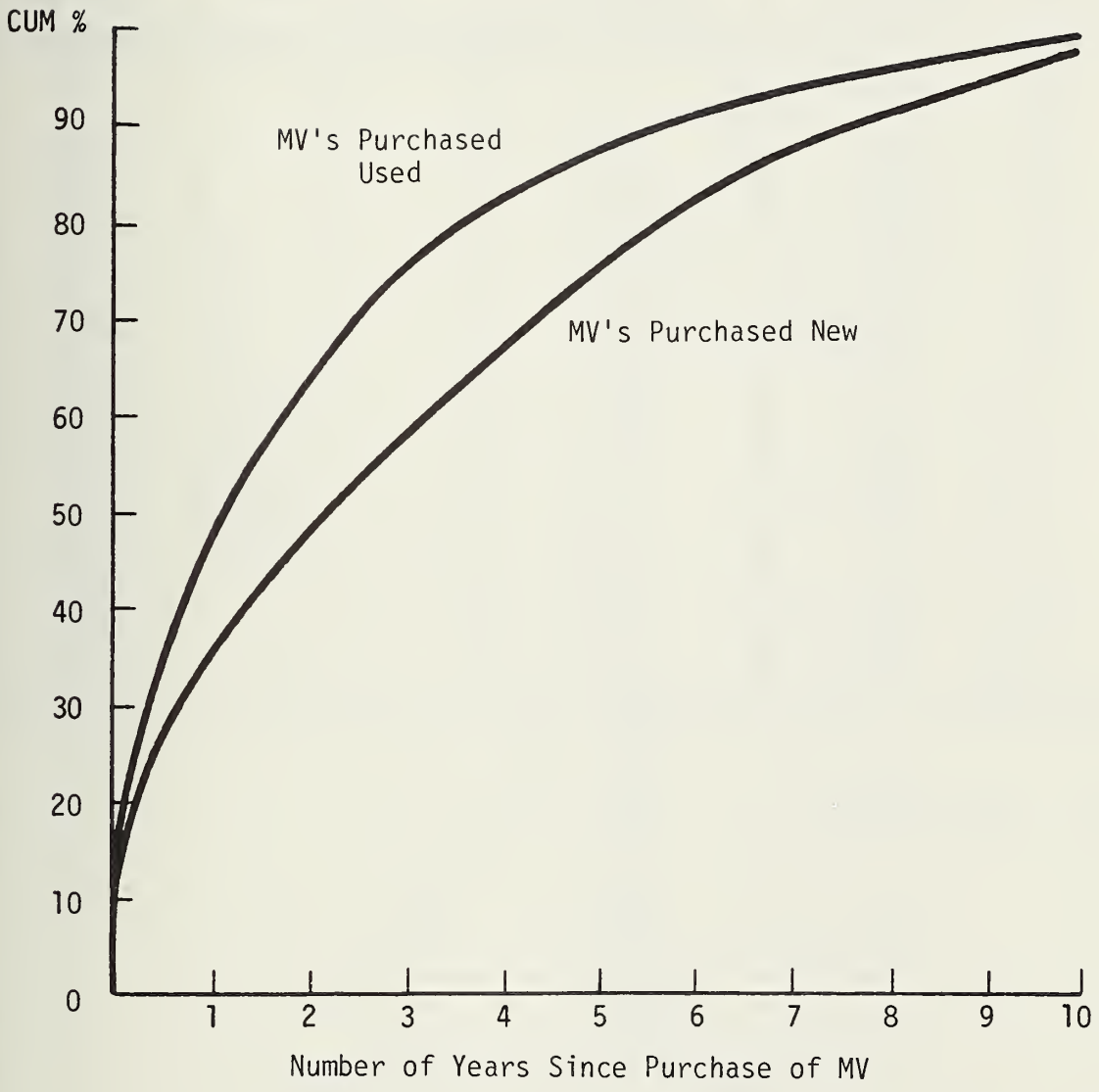
Since households hold motor vehicles purchased used for a shorter period of time than motor vehicles purchased new, (Figure 7-1 and Table 7-1), there are relatively more used motor vehicle purchases than the ownership proportion indicates. From the NSF survey,[1] it appears that there are roughly 160 used motor vehicle purchases for every 100 new motor vehicle purchases, or, that there were between 19 and 20 million used motor vehicle purchases in 1978.

The ratio of used to new motor vehicle purchases from the 1978 NSF survey is within the range of the ratios obtained from the Surveys of Purchase and Ownership which were conducted by the U.S. Bureau of the Census between 1969 and 1974.[2] 1974 was the last year that the Bureau conducted these surveys. It thus appears that, to date, AFER has had no discernible impact on the ratio of used to new motor vehicle purchases.

7.4 USED CAR OWNERS

A 1976 survey sponsored by U.S. News and World Report[3] estimated that 30 percent of all households owning automobiles owned used cars only. Income is the major difference between the households owning only cars bought used and those owning at least one car bought new (see Figure 7-2). Over half of all car-owning households with incomes of less than $7,000 owned only cars purchased used. With rising income, the proportion of the "used

*Superscripts refer to references in Appendix 7D.



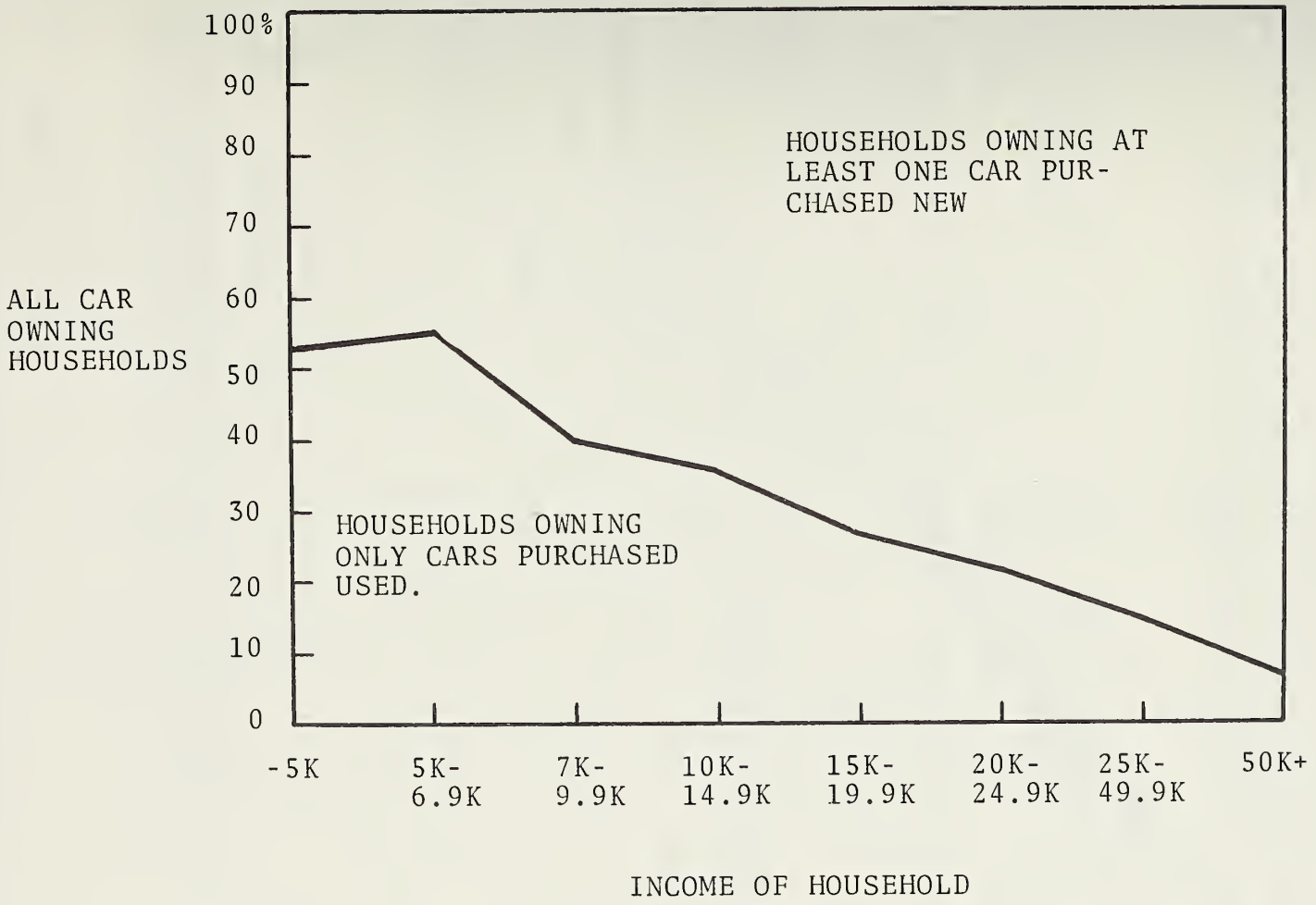
Source: Reference 1.

FIGURE 7-1. NUMBER OF YEARS SINCE CURRENTLY OWNED VEHICLES WERE PURCHASED

TABLE 7-1. NUMBER OF YEARS SINCE CURRENTLY OWNED VEHICLES WERE PURCHASED

YEAR PURCHASED	PERCENT OF ALL NEW VEHICLES	CUMULATIVE	PERCENT OF ALL USED VEHICLES	CUMULATIVE
1978	11.7	-	17.1	-
1977	22.4	34.1	29.6	46.7
1976	12.3	46.4	15.3	62.0
1975	10.2	56.6	12.7	74.7
1974	9.4	66.0	7.1	81.8
1973	9.3	75.3	5.7	87.5
1972	7.8	83.1	3.8	91.3
1971	3.5	86.6	2.4	93.7
1970	5.0	91.6	3.3	96.0
1969	3.2	94.8	1.0	97.0
1968	2.3	97.1	1.5	98.5
1967	1.6	98.7	.7	99.2
1966	1.2	99.9	.5	99.7

Source: Reference 1.



Source: Reference 3.

FIGURE 7-2. PERCENT OF "USED CAR ONLY" HOUSEHOLDS BY INCOME CATEGORY

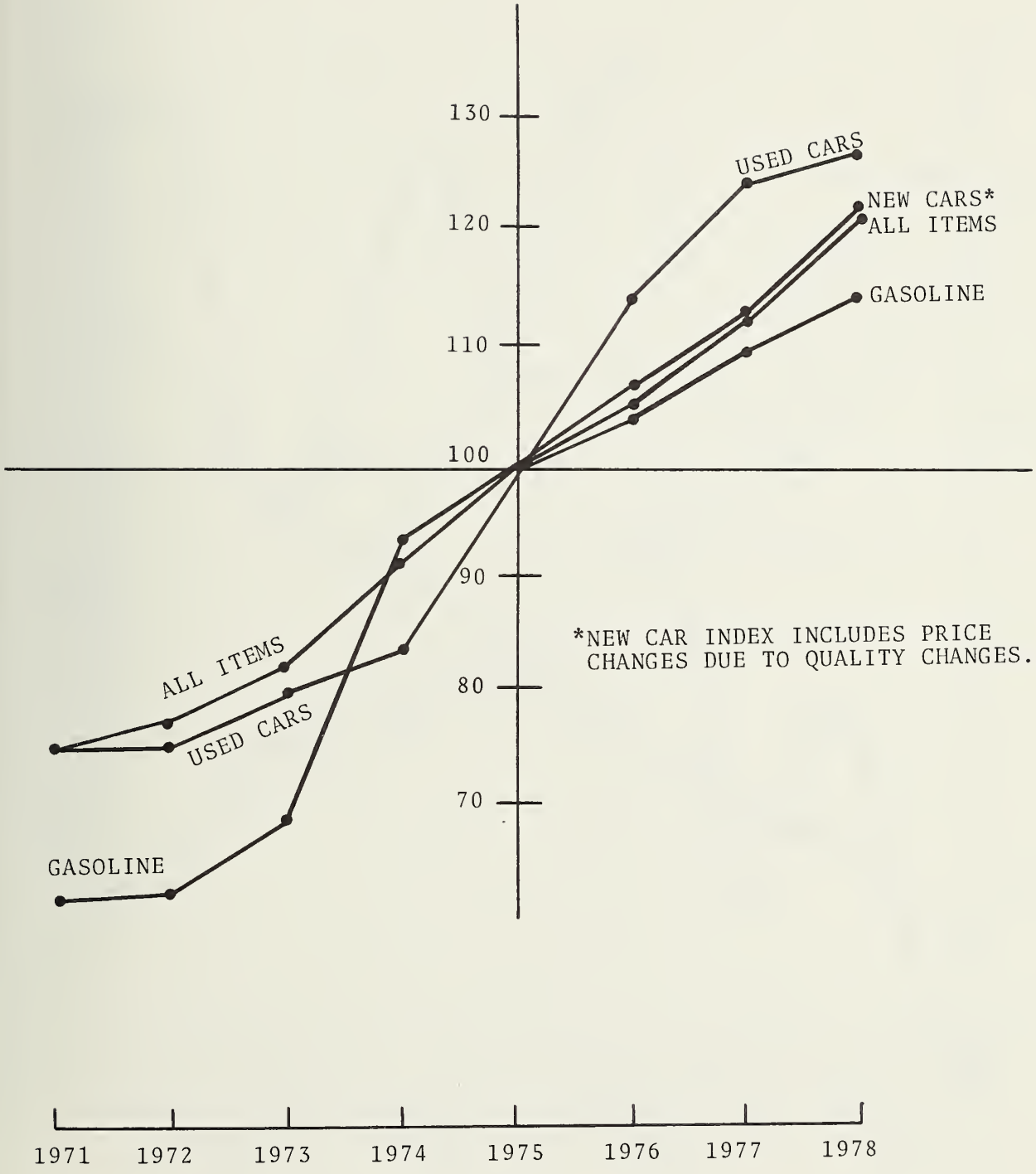
car only" households steadily declines, until only 7.5 percent of all car-owning households with income over $50,000 are used car only households.

Other demographic data on the heads of "used car only" households indicate that they also tend to be younger, less educated, more frequently single, and more frequently female than the heads of households owning cars bought new (see Appendix 7A).

7.5 USED CAR PRICES

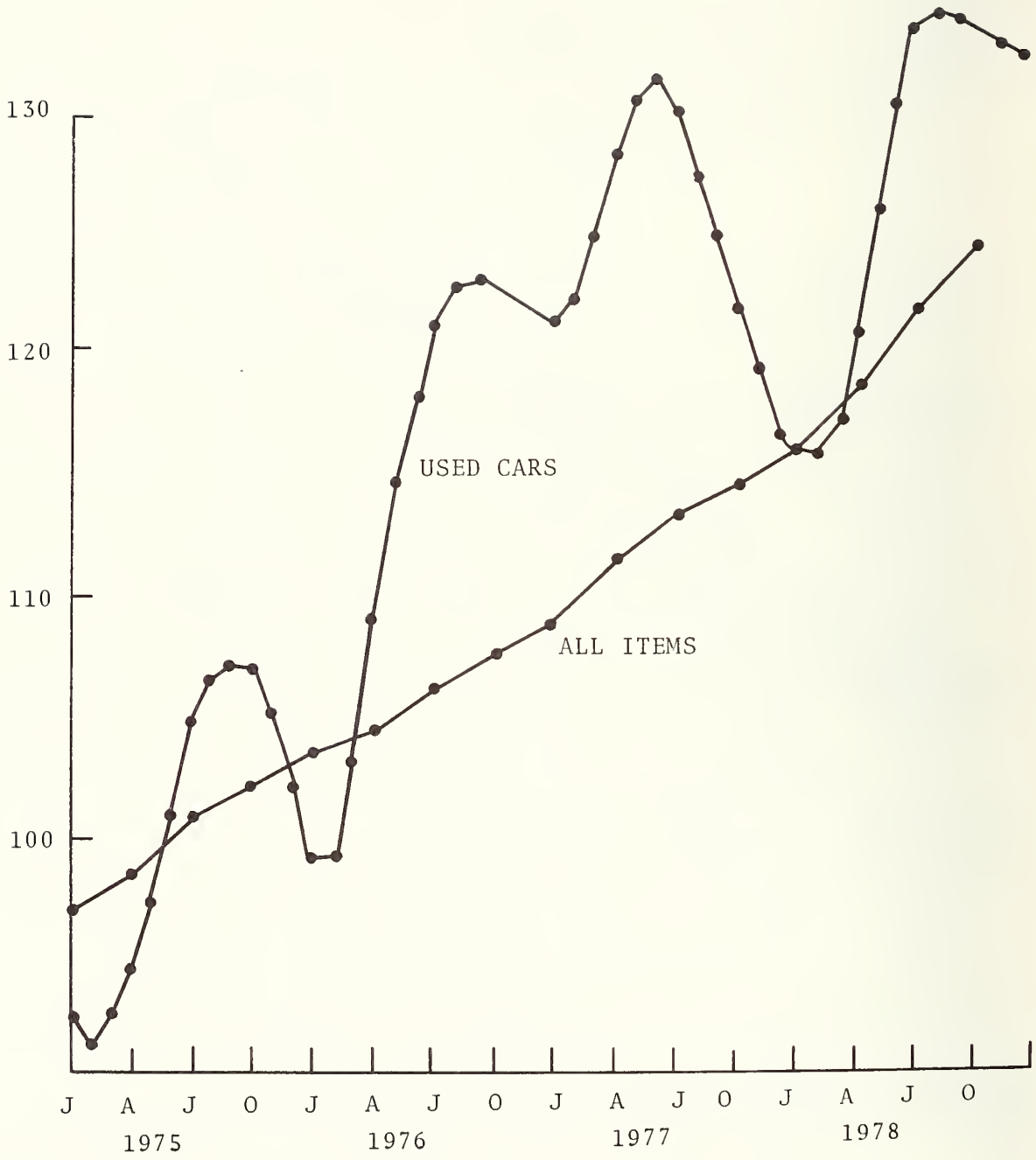
Since the passage of AFER, used car prices have risen at a faster rate than the general rate of inflation and the rates of price rise for new cars* and gasoline (see Figure 7-3). The sharp price rise in used cars, beginning in the fall of 1974, precedes AFER by about one year. At that time, the U.S. economy was entering a recession, and new cars for the first time had to have catalytic converters to meet the new EPA air quality standards. Probably both factors contributed to poor new car sales and the sharp rise in new car prices. The detailed monthly price indexes, unadjusted (Figure 7-4) and seasonally adjusted (Figure 7-5), show that used car prices rose sharply during 1976 and the spring of 1977. This was followed by a sharp price correction which lasted through the rest of 1977. The sharp rise during 1976 and early 1977 may have been in anticipation of downsizing, that is, the fear that the downsized cars would be a market failure. After the downsized standards proved themselves in the market place during the winter of 1976-1977, used car prices lost nearly half their 1976-1977 rise. Early in 1978, used car prices began to rise again; they rose sharply, seasonally adjusted, throughout 1978. The reason for the sharp used car price rise during 1978 may be the relative weakness of the new car market (see the discussion on "required sales" in Section 7.8).

*In this analysis, the new car price index includes price changes due to quality changes. The standard BLS new car price index omits these price increases. (See Part II, Section 9, Appendix 9A.)



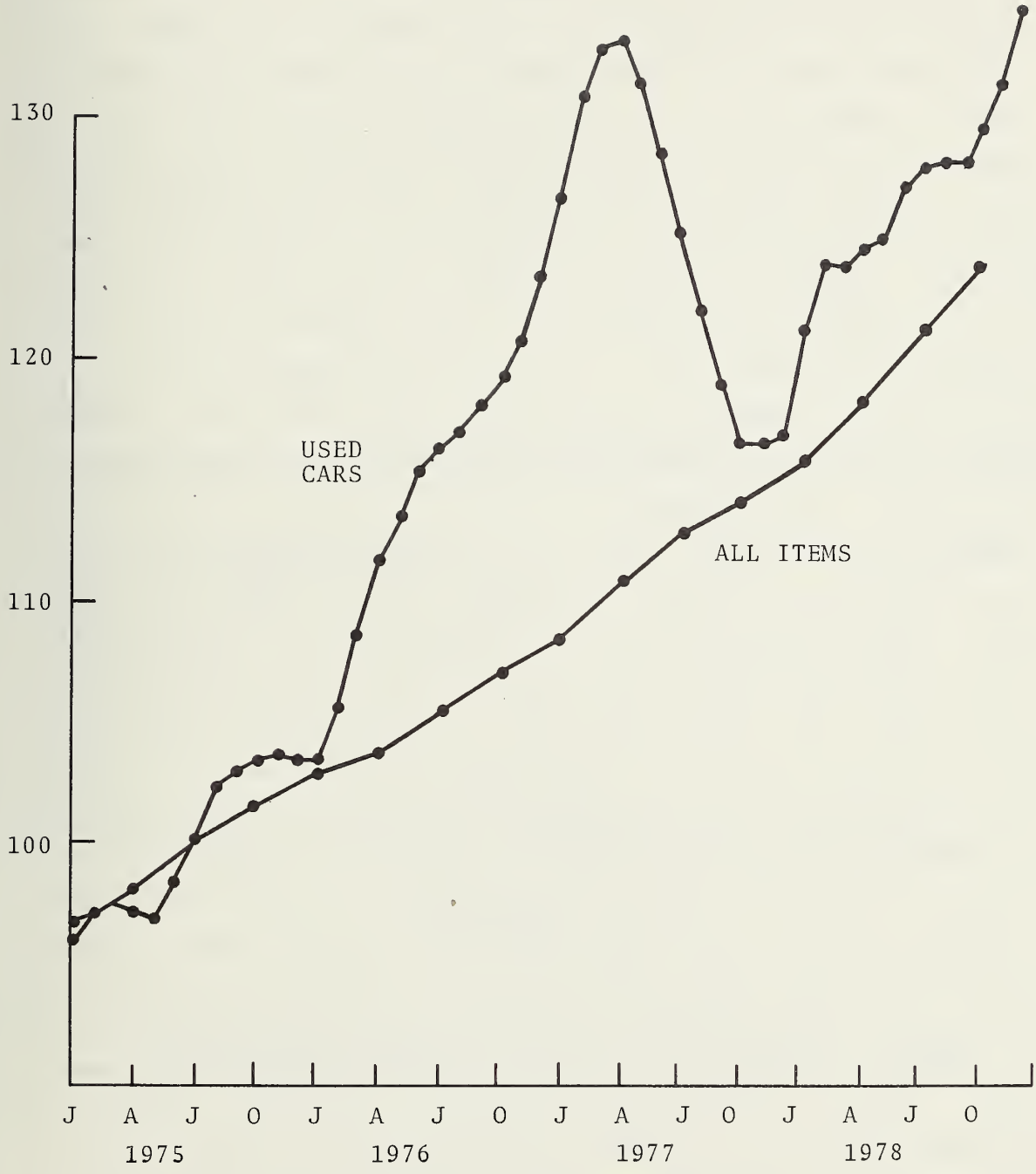
Source: Reference 4.

FIGURE 7-3. CONSUMER PRICE INDEX FOR NEW AND USED CARS AND GASOLINE (1975 = 100)



Source: Reference 4.

FIGURE 7-4. USED CAR PRICE INDEX - UNADJUSTED
(1975 = 100)



Source: Reference 4.

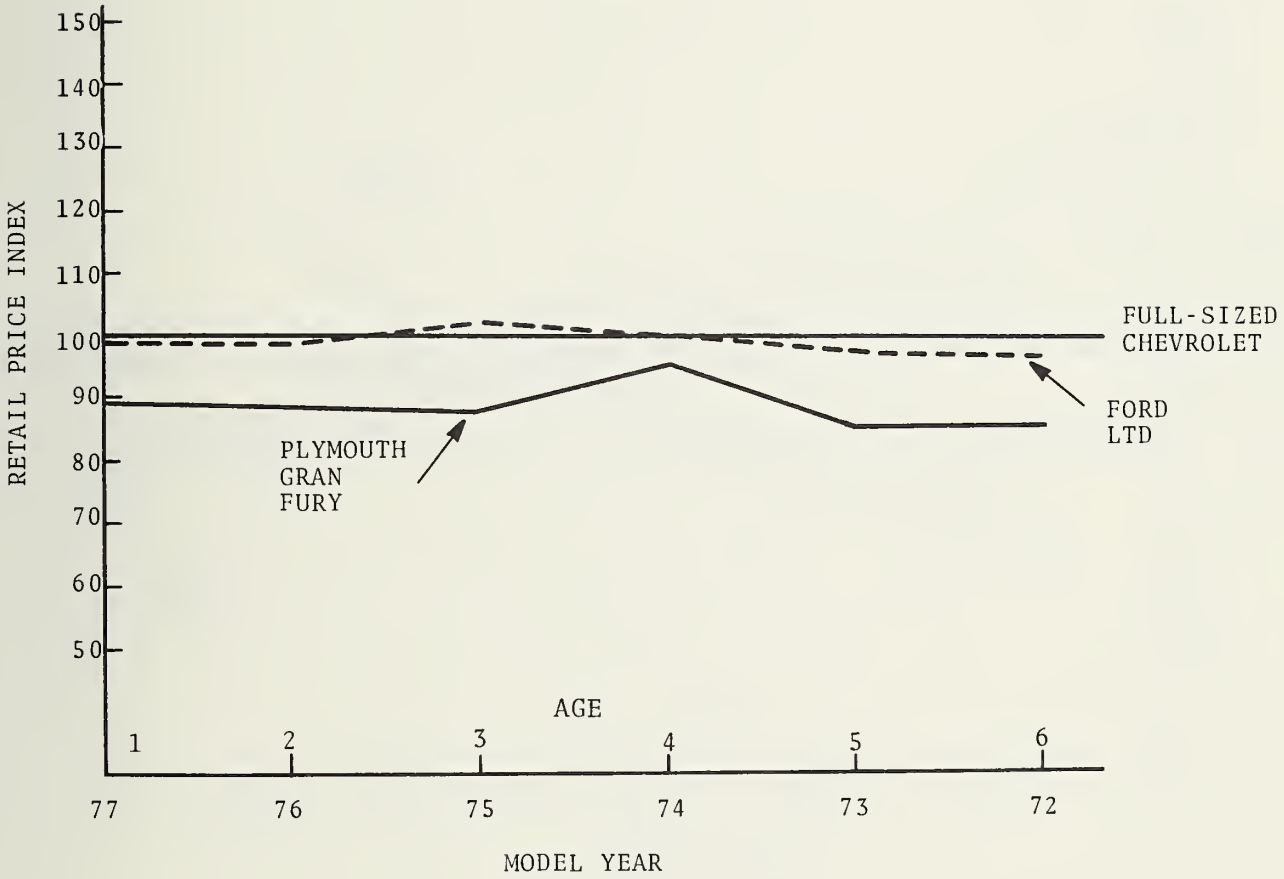
FIGURE 7-5. USED CAR PRICE INDEX - SEASONALLY ADJUSTED (1975 = 100)

7.6 USED CAR PRICES BY MARKET SEGMENT

In the model years 1972 and 1973, full-sized cars accounted for slightly over 40 percent of all new domestic car sales. By 1978, the market share of these cars was less than 25 percent. Thus, today, among the six and seven year old used cars, there is more than a 60 percent "oversupply" of full-sized cars if measured by current new car market share demands. This "oversupply" is reflected in used car prices (see Figures 7-6 through 7-10 and Appendix 7B). Figure 7-6 shows the fall of 1978 used car retail prices of the full-sized Plymouth and Ford relative to the full-sized Chevrolet by model year. The Ford and Plymouth cars depreciated slightly faster than Chevrolet cars since their slopes are slightly negative. The difference between the three makes, however, is not very pronounced.

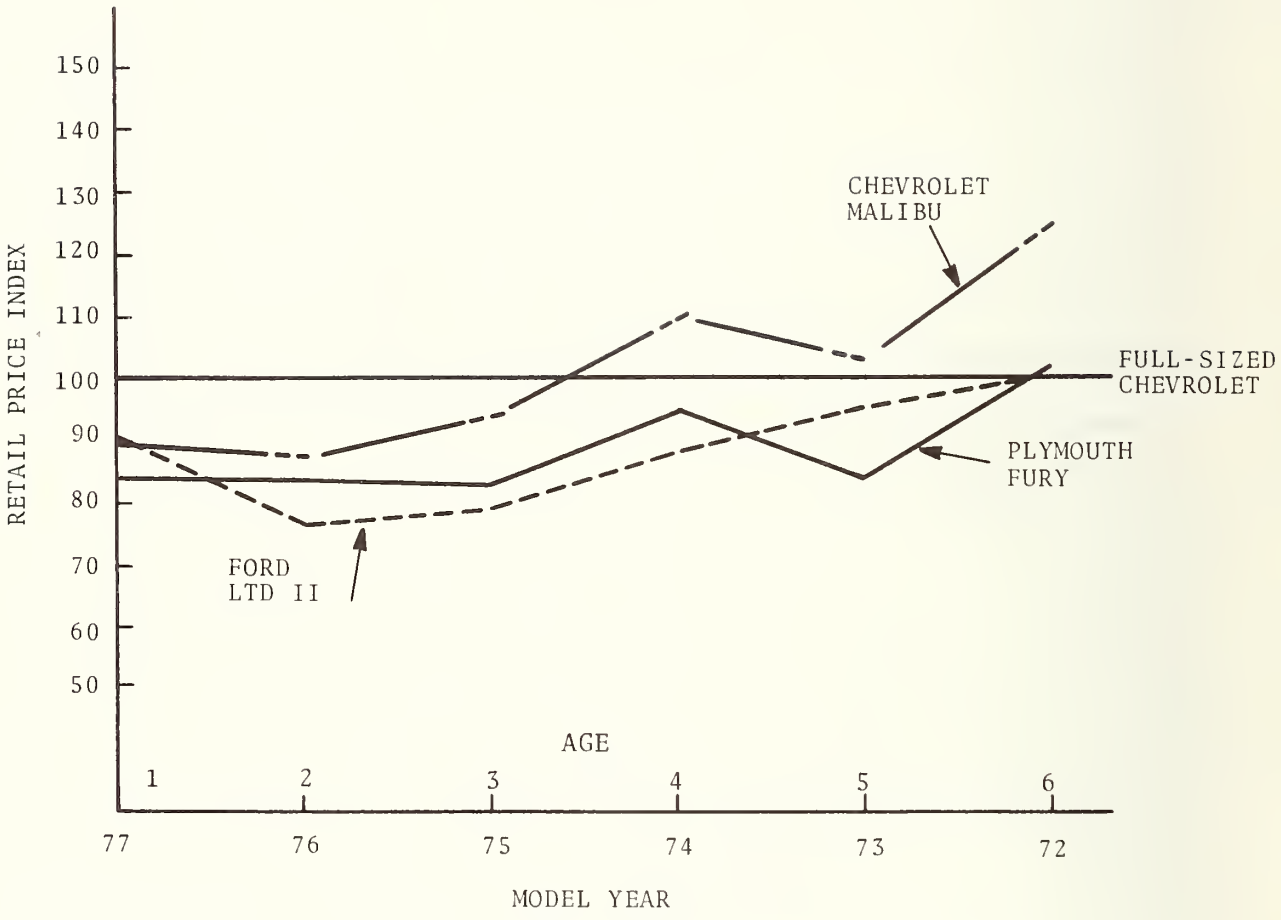
A comparison of three makes of intermediate cars with the full-sized Chevrolet (Figure 7-7) shows that for model year 1976 and older, the depreciation of the intermediate is considerably less (has a positive slope) than for the full-sized Chevrolet. For model years 1974, 1973, and 1972, an intermediate Chevrolet Malibu is actually worth more than a full-sized Chevrolet Impala of the same vintage. In recent years, compact cars have had even a slower relative depreciation rate (Figure 7-8). In the fall 1978 used car market, an equally equipped and in the same condition compact Chevrolet Nova of vintage 1975 to 1972 had a higher retail value than the full-sized Chevrolet Impala of the same age. For model years 1973 and 1972, even the compact Ford Maverick and the Plymouth Valiant were priced higher than the full-sized Chevrolet. Except for the 1972 Ford Pinto subcompact (Figure 7-9), no subcompact outpriced the full-sized Chevrolet; still, the depreciation rate of the subcompact was considerably less than the full-sized Chevrolet.

Among used station wagons, the older model intermediates also tend to be higher priced than the full-sized wagons (see Figure 7-10).



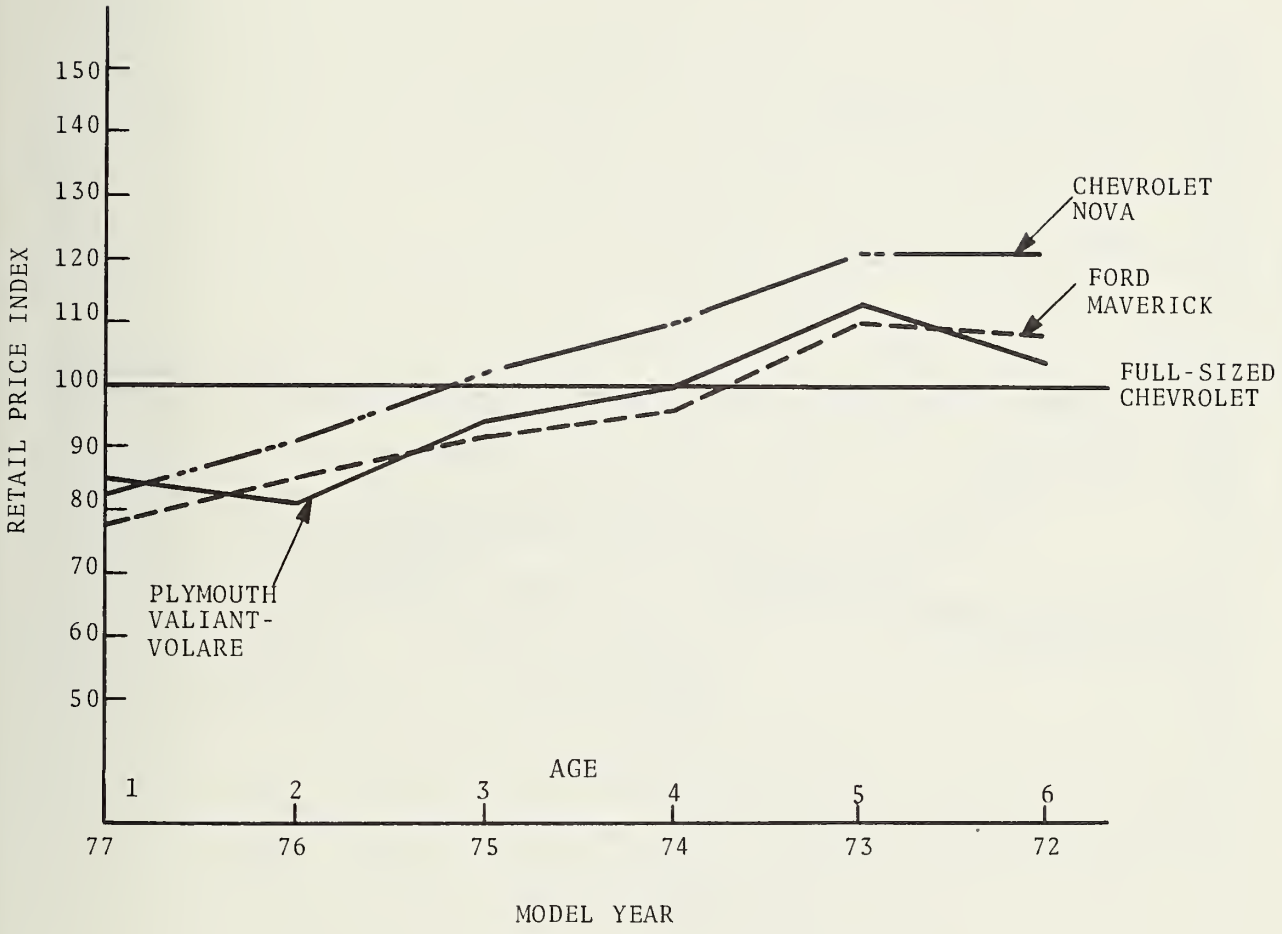
Source: Derived from 1978 Red Book Data (Reference 5) (See Appendix C).

FIGURE 7-6. USED CAR RETAIL PRICES, FULL-SIZED CAR PRICES NORMALIZED TO RETAIL PRICE OF THE FULL-SIZED CHEVROLET FOR MODEL YEARS 1972-1977



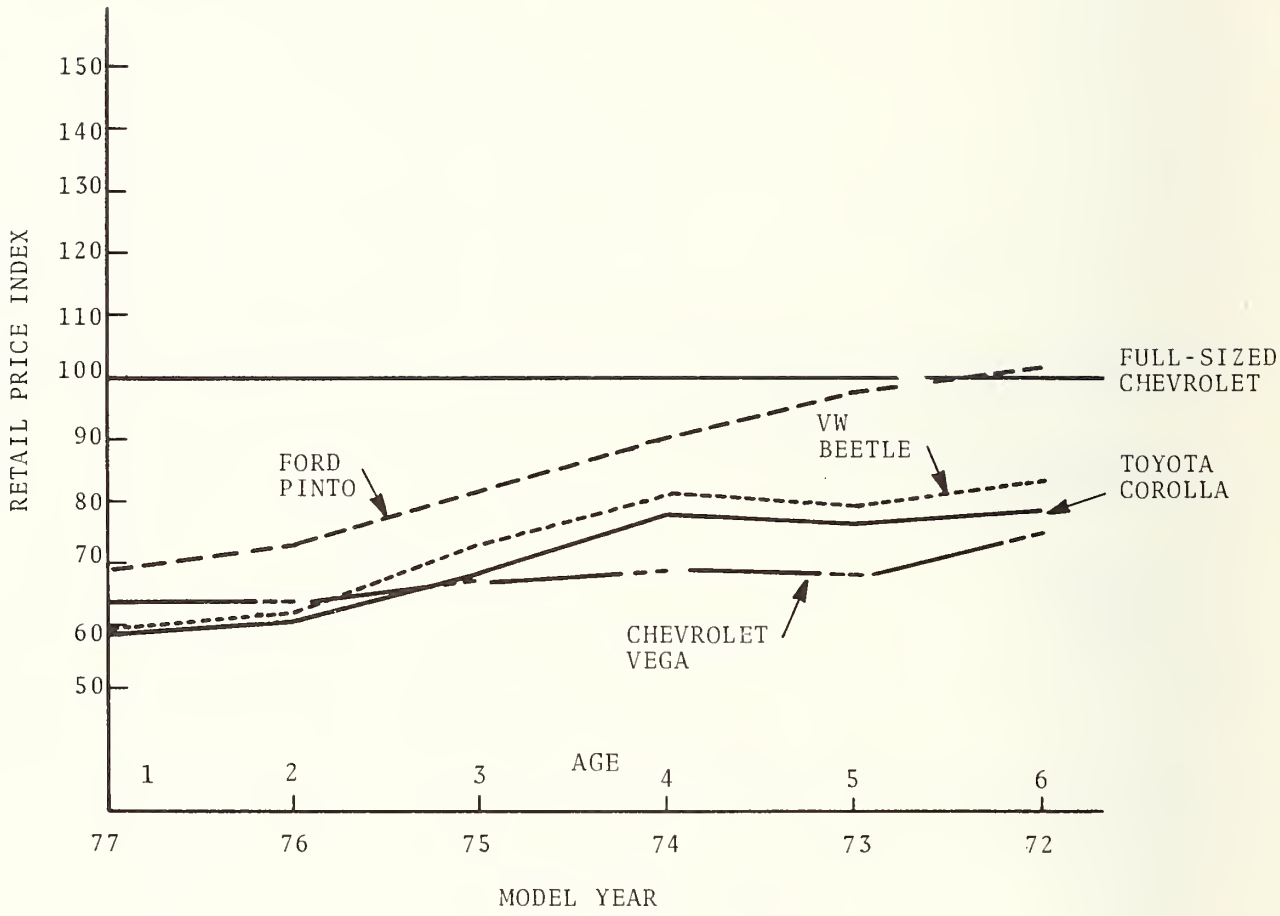
Source: Derived from 1978 Red Book Data (Reference 5) (See Appendix C).

FIGURE 7-7. USED CAR RETAIL PRICES, INTERMEDIATE CAR PRICES NORMALIZED TO RETAIL PRICE OF THE FULL-SIZED CHEVROLET FOR MODEL YEARS 1972-1977



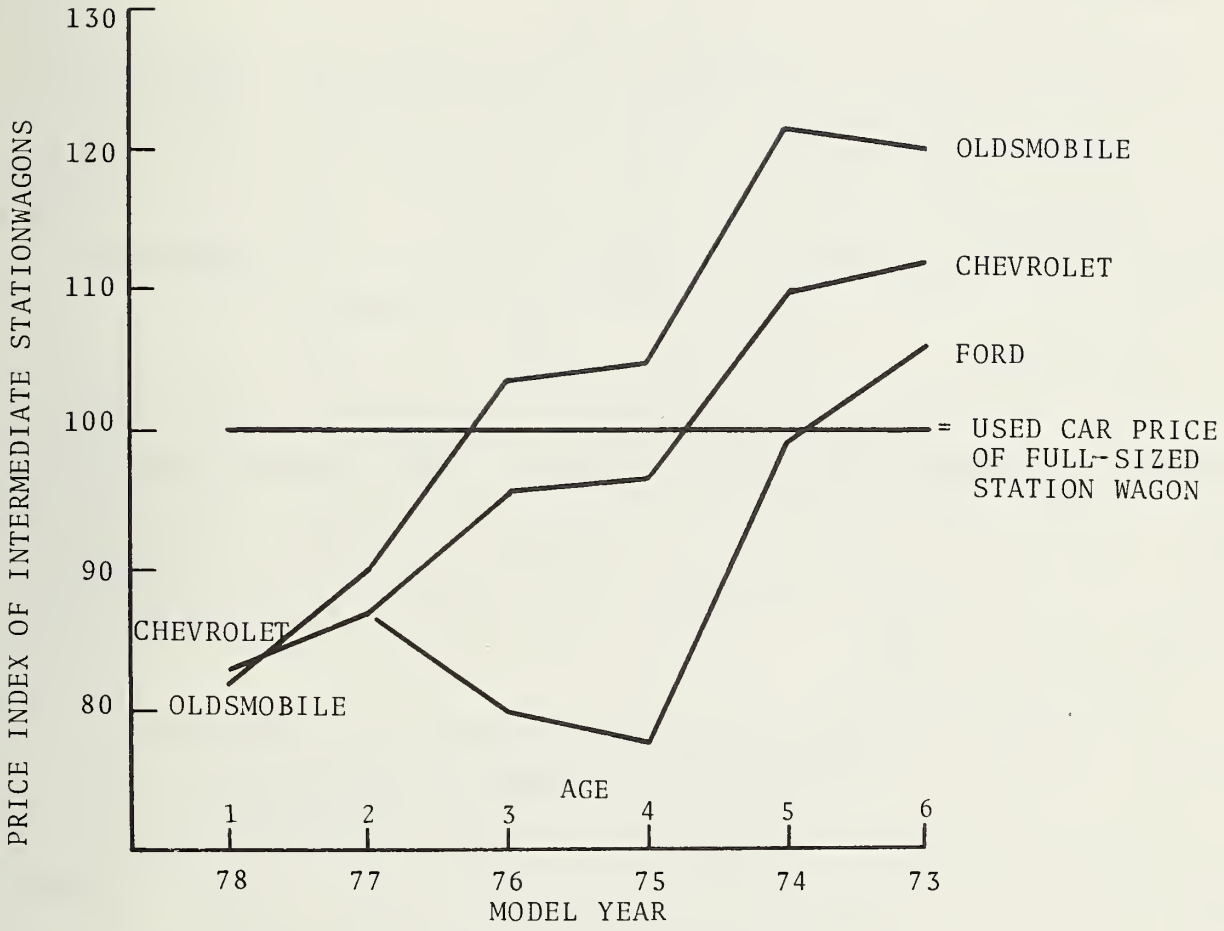
Source: Derived from 1978 Red Book Data (Reference 5) (See Table 1, Appendix C).

FIGURE 7-8. USED CAR RETAIL PRICES, COMPACT CAR PRICES NORMALIZED TO RETAIL PRICE OF THE FULL-SIZED CHEVROLET FOR MODEL YEARS 1972-1977



Source: Derived from 1978 Red Book Data (Reference 5) (See Appendix C).

FIGURE 7-9. USED CAR RETAIL PRICES, SUBCOMPACT CAR PRICES NORMALIZED TO RETAIL PRICE OF THE FULL-SIZED CHEVROLET FOR MODEL YEARS 1972-1977



Source: Reference 6 (See Appendix C).

FIGURE 7-10. USED CAR PRICES OF INTERMEDIATE STATION WAGONS NORMALIZED ON USED CAR PRICES OF FULL-SIZED STATION WAGONS OF SAME MAKE AND MODEL YEAR

The present supply imbalance by market segment between used and new cars can be expected to disappear in the next few years. When this occurs, one can expect that cars of all market segments will again be depreciated at roughly the same rate.

7.7 CHANGES IN EXPECTED VEHICLE LIFE

One estimate of the scrappage rates within the registered motor vehicle fleet is the "expected life" of motor vehicles. This "expected life" is the average number of years motor vehicles remain in the registered fleet, if the current scrappage rate by specific vehicle age continues indefinitely. When scrappage declines, the expected vehicle life rises and vice versa.

Using this measure of scrappage, it can be seen that since the energy crisis of 1973, the expected life of automobiles has increased (see Figure 7-11 and Table 7-2). The expected automobile life is still higher than it was prior to the energy crisis, even though expected automobile life declined in both of the last two years for which we have data, that is, the years ending June 30, 1976 and June 30, 1977.

The likelihood that a car will be scrapped is generally a function of its age. However, the trends in the survival rate, the corollary of the scrappage rate, are not the same for all ages. In general, the survival rates for cars less than 6 years old have slightly decreased over the past decade and were, in 1977, lower than in any year since before 1965 except 1970 and 1973 (Figure 7-11 and Table 7-2). In 1977, the changes were that one car in eleven would be scrapped before it was six year old, whereas a decade earlier this happened only to one car out of every 16 to 17 cars. The sharp rise in the vulnerability of new cars in accidents and the higher costs to repair cars are usually blamed for the greater scrappage of new cars. This new car scrappage is nearly totally due to accidents in which the car is "totaled." In the past decade, there was a general and persistent trend toward greater survivability of the middle-aged car (6 to 11 years). This

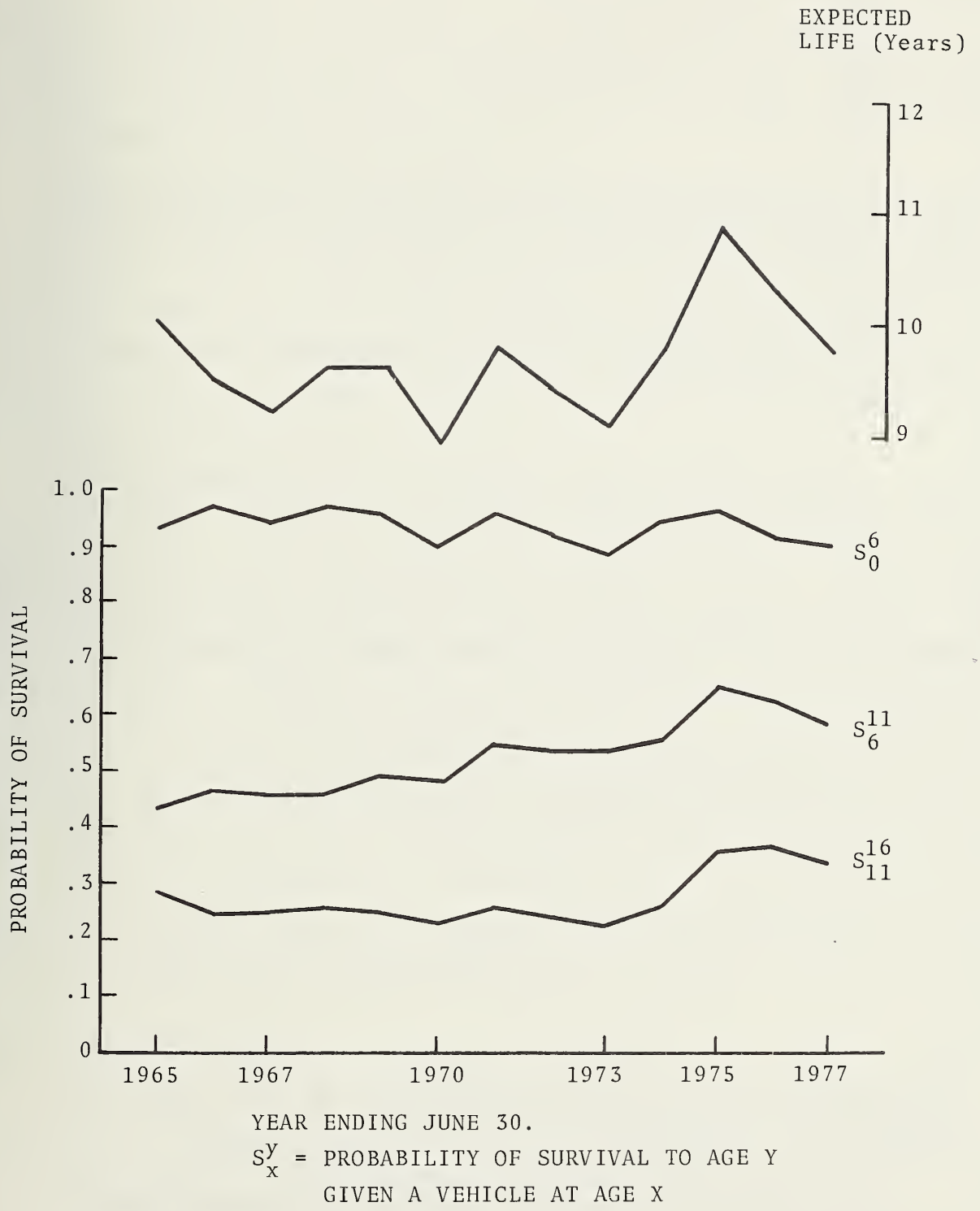


FIGURE 7-11. AUTOMOBILE SURVIVAL IN THE REGISTERED FLEET

TABLE 7-2. AUTOMOBILE SURVIVAL IN THE FLEET

YEAR ENDING JULY 1	EXPECTED LIFE (YEARS)	S_0^6	S_6^{11}	S_{11}^{16}
1965	10.0	0.93	0.43	0.29
1966	9.5	0.97	0.47	0.25
1967	9.2	0.94	0.46	0.25
1968	9.6	0.97	0.46	0.26
1969	9.6	0.96	0.49	0.25
1970	8.9	0.90	0.48	0.23
1971	9.8	0.96	0.55	0.26
1972	9.4	0.92	0.54	0.24
1973	9.1	0.89	0.54	0.23
1974	9.8	0.95	0.56	0.26
1975	10.9	0.97	0.66	0.36
1976	10.3	0.92	0.63	0.37
1977	9.8	0.91	0.59	0.34
1978	10.3	0.92	0.59	0.31

S_x^y = Probability of Survival to Age y Given a Vehicle Age x

is the age when, traditionally, most cars get scrapped. The rise in the survivability is clearly a sign that people tend to hold on longer to these cars. However, it is well to note that the increased survivability of the middle-aged cars is not something that began with the energy crisis or AFER, but is a trend that dates back at least to the mid-fifties.

When it comes to the 11 to 16 year old cars, the "clunkers," we note that their survival rate was fairly steady without much of a trend until 1974. Since then, however, the survival of these "clunkers," model years 1966 and older, has improved markedly. People clearly are holding on to their old, old cars more today than at anytime, at least since the mid-1960's if not since the war years of World War II.

Trucks generally survive longer than cars (see Figure 7-12 and Table 7-3). However, with trucks, the general trend is toward shorter vehicle life and lower survival rates. This trend has been particularly pronounced since 1975. One can presume that these drops in survival rate are due to the greater personal use of light trucks. Light trucks account for 90 percent of trucks in the fleet and completely dominate the survival and expected life data. As light trucks become surrogate passenger cars, one can expect that they will be owned and driven increasingly by more people who have only limited technical know-how and limited capabilities to maintain their own machinery. In short, one can expect that light trucks will approach the survivability of cars, and this is apparently occurring.

7.8 "REQUIRED" SALES

To estimate what is occurring in the registered fleet, particularly if "expected vehicle life" is expanding or contracting, TSC has developed a methodology to estimate the direction of change in vehicle life from current motor vehicle sales data. The latest sales data are available monthly, and roughly within 3 weeks after the end of the month. Registration data are available annually, and roughly 9 to 10 months after the end of

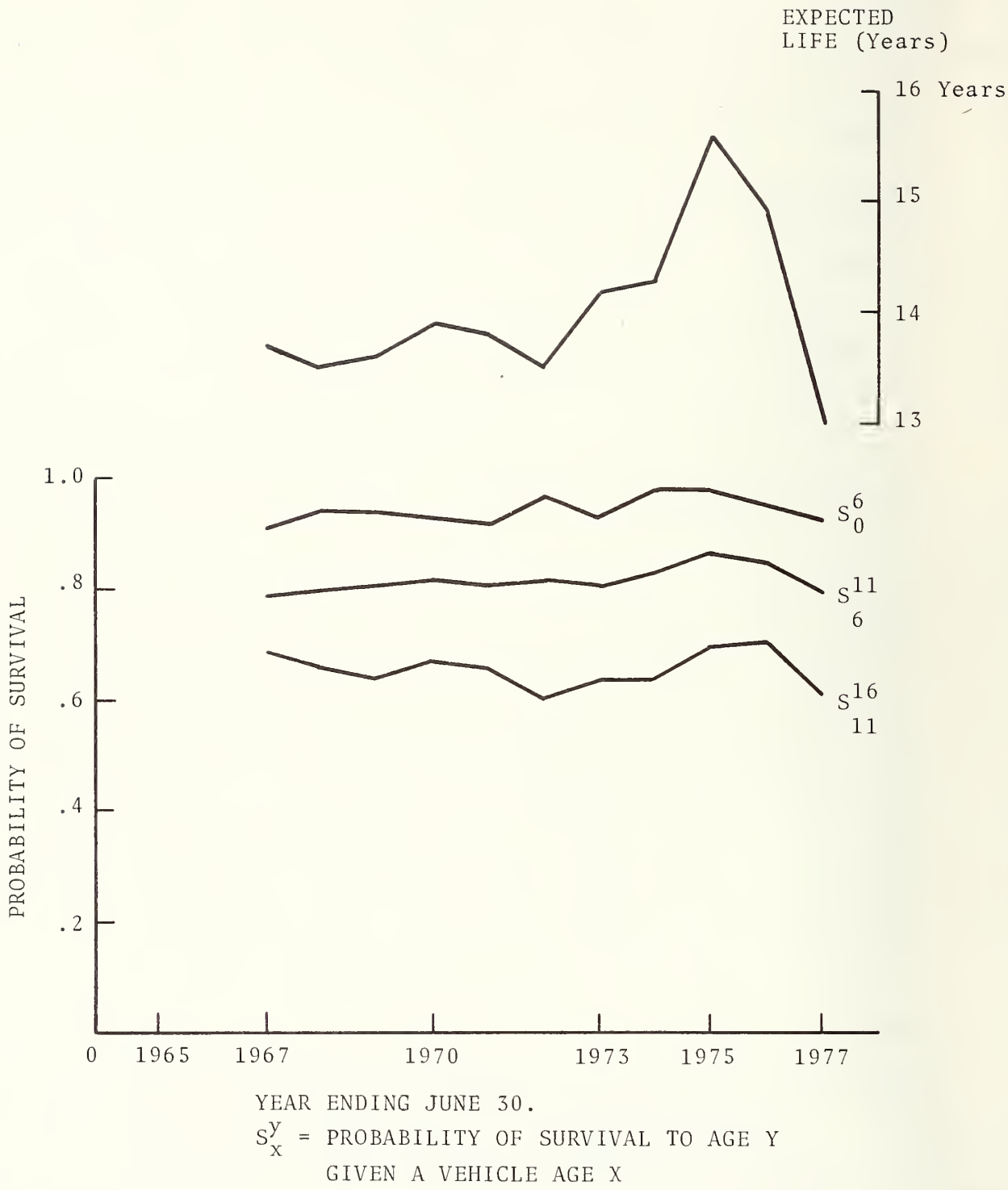


FIGURE 7-12. TRUCK SURVIVAL IN THE REGISTERED FLEET

TABLE 7-3. TRUCK SURVIVAL IN THE FLEET

YEAR ENDING JULY 1	EXPECTED LIFE (YEARS)	S_0^6	S_6^{11}	S_{11}^{16}
1967	13.7	0.91	0.79	0.69
1968	13.5	0.94	0.80	0.66
1969	13.6	0.94	0.81	0.64
1970	13.9	0.93	0.82	0.67
1971	13.8	0.92	0.81	0.66
1972	13.5	0.97	0.82	0.60
1973	14.2	0.93	0.81	0.64
1974	14.3	0.98	0.83	0.64
1975	15.6	0.98	0.87	0.70
1976	14.9	0.95	0.85	0.71
1977	13.0	0.93	0.80	0.62
1978	13.9	0.95	0.79	0.61

S_x^y = Probability of Survival to Age y Given a Vehicle Age x

the registration year. Thus, it is useful to have a method to estimate scrappage rates from current sales data. The method developed by TSC uses the concept of "required" sales (see Appendix 7C); these are the projected sales that are needed to increase the registered fleet at the rate of household growth, and at current scrappage (survival) rates. The estimated and actual sales for the year ending June 30, 1978 are shown in Table 7-4.

As Table 7-4 indicates, the 1977/78 total motor vehicle sales are considerably below the "required" sales, and light truck sales are above the "required" sales. These data suggest that the life expectancy of cars is increasing, and that the car scrappage rates are decreasing. This signals a reversal of the trend of the last two years when the life expectancy of cars was decreasing. For trucks, the data suggest that life expectancies and survival rates are still decreasing.

Though the deficiency in car sales is balanced by the excess in truck sales, it would be fallacious to assume that the excess truck sales are all due to a shift from cars to trucks. Some of the sales can possibly be explained in this manner, but most of the sales probably represent an increase in the registered motor vehicle fleet.

Though the automobile has been with us for some 70 years, and has completely dominated all types of trip making for at least 25 years, the registered passenger car fleet is still growing and at a faster rate than household formation, total population, driving age population, and real median income (see Table 7-5). Furthermore, truck registrations are growing at a higher rate than passenger car registrations.

In other words, the motor vehicle continues to be a growing element in U.S. society. U.S. society is still reorganizing its land use and activity patterns to greater motor vehicle ownership and use rates. With the low 1977 to 1978 automobile sales, the slight expansion of the passenger cars per household ratio was because unusually few cars were scrapped that year. With the

TABLE 7-4. "REQUIRED" AND ACTUAL MOTOR VEHICLE SALES
(July 1, 1977 to June 30, 1978)

	"REQUIRED" SALES (000s)	ACTUAL SALES (000s)	ACTUAL LESS "REQUIRED" SALES (000s)
Passenger Cars	11,064	9,235	-1,829
Light Trucks	1,808	3,556	+1,748
Total	12,872	12,791	-81

TABLE 7-5. PERCENT GROWTH IN MOTOR VEHICLE REGISTRATION AND SOCIAL INDICATORS, 1973 TO 1977

	PASSENGER CAR REGISTRATION	TRUCK REGISTRATION	VEHICLE MILES TRAVELED	POPULATION ALL	POPULATION 16 AND OVER	HOUSEHOLDS	MEDIAN HOUSEHOLD INCOME (CONSTANT $)
1976-77	2.1	6.3	4.0	.7	1.7	1.8	.5
1975-76	2.7	7.0	4.6	.7	1.7	2.5	1.6
1974-75	2.8	6.4	3.4	.7	1.7	1.8	-3.4
1973-74	3.1	8.9	-2.6	.7	1.7	2.4	-4.8

Source: References 7,8, and 12.

strong light truck sales, the total motor vehicles per household ratio expanded between July 1, 1977 and June 30, 1978.

7.9 PROJECTED AFTER IMPACTS ON THE USED CAR MARKET

To date, the impacts of AFER on the used car market appear to be overshadowed by the impact of the EPA's emission controls. Since 1974, new car sales have been far from impressive. With a steadily growing registered passenger car fleet every year, higher new car sales records must be set to maintain the average age of the registered fleet. This has not happened; the fleet has aged and used car prices have increased sharply. Some people quite clearly are rejecting the new car offerings, are holding on to their old cars, and are shopping in the used car market. The reasons for this trend are not, as yet, clear from Automotive Fuel Economy research. It can be purely economical; income has not kept pace with inflation since the energy crisis. It can be pollution controls; it can be AFER, downsizing, and weight reduction. It will be another year before we can use used car auction prices to evaluate the acceptance of the AFER car designs.

Subtle changes, quite unrelated to government regulation, are occurring in the new and used car market. Until the 1960's, new and used cars were traded with equal frequency. Now people tend to keep their new cars longer than the cars they purchase used. The sharp difference in the holding period of new and used cars (Figure 7-1) is only a trend of the past ten to fifteen years. The trend may be associated with multi-car ownership and, in recent years, the four and five year new car contracts.

The longer installment contracts have opened up the new car market to many new buyers. This trend was also materially aided by the availability and popularity of low prices foreign and domestic compacts.*

*The trade-in on foreign and domestic compacts is more likely a used car than for any other market segment.[9]

The relative size of the used car market is shrinking. Cars enter the used car market later in their registered life, and more people buy new cars. Still, until 1978, the last year for which data are available,[1] the percent of households without a motor vehicle has sharply decreased. Thus, it appears that, at least through 1978, no group of persons was squeezed out of the motor vehicle market. With current trends, such a squeeze can occur. The percent of personal consumption expenditures devoted to transportation has been climbing during the last few years and is at an all time high.[10] This, combined with poor new car sales, high used car prices, and the reduced share of the aggregate income in the second and the third fifth of all households,[8] forms a potential time bomb which, at least in theory, can drastically lower the motor vehicle availability to average and below average income households.

The economic necessity of motor vehicle ownership for most households makes such a scenario extremely unlikely. A continuing and sharp increase in the survival rates of 6 to 11 and 11 to 16 year old cars is more likely. People will hold on to their old cars. To make this practically feasible, they will drive the old cars less. In addition, one can expect that through the political process there will be strong pressures to water down any existing or proposed inspection and insurance requirements.

In the long run, the impact of AFER on the used car market will be determined by the durability, reliability, maintainability, and catastrophic failure rate of the fuel efficient vehicles. The more durable the AFER cars are, the longer they will last in the registered fleet. This, in turn, will be a determinant of their depreciation rate and, with it, of the price they command in the used car market.

People tend to trade their cars in if they require costly repairs, or when they need repairs frequently.[9] This tendency

makes reliability, i.e., the frequency of unscheduled maintenance, a major factor in determining the relative size of the used car market. The relative size of the used car market means the number of used car purchases per 100 new car purchases. If new cars are relatively reliable, and the reliability does not decrease markedly with age and/or mileage, the used car market can be expected to be smaller than if there is a strong relationship between a car's reliability, its age, and/or mileage.

Finally, maintainability and the catastrophic failure rate impact the size of the used car market and the cost of a car that delivers "minimum transportation." When older cars are likely to stop functioning suddenly as "minimum transportation" and require major repairs, such as the replacement of the automatic transmission, people are more likely to buy new rather than used cars. It is probably far from a historical accident that the inexpensive imports became popular in the U.S. market at the same time that cars with automatic transmissions began to dominate the used car market. Both of these events occurred in the late 1950's. The automatics were far more likely to have "catastrophic failures" than the older stick shift cars. The likelihood of "catastrophic failures" has generally increased over time as the essential drivetrain, steering, and braking mechanisms became more complex. With it, the cost of "minimum transportation" has also increased. The $20 transportation of the 1940's has become the $50 car of the fifties, the $75 car of the sixties, and the $200 plus car of the late 70's. If, as a result of AFER, cars must be tuned within relatively close tolerances just to operate, and if engine/drivetrain repairs will increase in their complexity and costs, then we can project higher "minimum transportation" prices than today. This will also imply a relative shrinking of the used car market, and an increase in the new cars purchased with very long financing.

7.10 REFERENCES FOR SECTION 7 AND APPENDICES 7A, 7B, AND 7C

1. Cambridge Systematics, Inc./Westat, Inc.: "Analysis of Motor Vehicle Ownership and Household Travel Patterns," Volume 1, Part 1.

2. U.S. Bureau of Census: 1974 Survey of Purchase and Ownership and P-65 publications.

3. "The Study of American Markets - Automotive Market," Marketing Department of U.S. News and World Report, 1977 Report.

4. TSC Analysis of Consumer Price Index-Bureau of Labor Statistics Base 1975=100 for New and Used Cars, Private Transportation, All Items, and Gasoline.

5. Region A, Red Book Official Used Car Valuations, National Market Reports Inc. October 1 - November 14, 1978 Subsidiary of Maclean-Hunter Publishing Corp., Chicago, Illinois.

6. Automotive Market Report, January 17, 1979, "Used Car Wholesale Prices of Zone 1 (Northeast-Midwest) for 'Sharp' Cars with Automatic Transmission, Air Conditioning, Power Steering, and Vinyl Roof."

7. MVMA: "Motor Vehicle Facts and Figures," 1978.

8. U.S. Department of Commerce, Bureau of the Census: Current Population Reports P20-327, P25-721, and P60-117.

9. Newsweek: "Buyers of New Domestic/Import Cars 1977."

10. Survey of Current Business, July 1978.

11. Ward's Automotive Yearbook, 1977, 1978.

12. U.S. Department of Transportation: "Traffic Volume Trends," December, 1978.

APPENDIX 7A

USED CAR OWNERS

The data used in this section on the owners of used cars are derived from the U.S. News and World Report, "Study of American Markets: The Market for Automobiles" published in 1977.[3] In 1976, U.S. News and World Report sponsored a survey of approximately 12,000 household heads owning one or more cars. From this sample, estimates were made of all the auto owning households in the United States. Tables 7A-1 through 7A-5 contain selected demographic data obtained from the survey:

TABLE 7A-1. SEX OF HOUSEHOLD HEAD AND TYPES OF CARS OWNED

Sex of HH Head	HH Owning Cars Bought New (%)	HH Owning Used Cars Only (%)
Male	83.0	79.4
Female	17.0	20.6

TABLE 7A-2. MARITAL STATUS OF HOUSEHOLD HEAD AND TYPES OF CARS OWNED

HH Marital Status	HH Owning Cars Bought New (%)	HH Owning One or more Used Cars only (%)
Married	78.1	70.4
Single	8.6	11.3
Widowed	7.7	7.6
Divorced or Separated	5.6	10.7

TABLE 7A-3. EDUCATION OF HOUSEHOLD HEAD AND TYPES OF CARS OWNED

Education of HH Head	HH Owning cars Bought new (%)	HH Owning One or more used Cars only (%)
Post Grad Degree	11.4	6.6
Post Grad Work, no degree	7.1	3.6
College Grad, no post Grad	14.8	11.2
Total College Grad	33.4	21.5
Attended College (no grad)	18.2	18.1
Now in College	3.0	3.7
Attended College 1+ Years	54.5	43.3
HS Grad, no College	29.7	34.0
Not HS Grad	15.7	22.0

TABLE 7A-4. HOUSEHOLDS WITH "USED CARS ONLY" OF ALL CAR OWNING HOUSEHOLDS BY INCOME GROUP

Income ($)	a No. of HH with used Cars only (000's)	b No. of HH with Cars (000's)	HH with used cars Only (a/bx100%)
Under 5K	2289	4309	53.1
5K-6.9K	2016	3672	54.9
7K-9.9K	2506	6303	39.8
10K-14.9K	5086	14054	36.2
15K-19.9K	2942	10860	27.1
20K-24.9K	1816	8320	21.8
25K-49.9K	1380	9338	14.8
50K+	127	1702	7.5

TABLE 7A-5. AGE OF HOUSEHOLD HEAD AND TYPES OF CARS OWNED

AGE OF HH Head	HH Owning Cars Bought new (%)	HH Owning one or More used cars Only (%)
Under 18	*	.1
18-24	4.1	10.4
25-34	20.6	26.2
35-44	18.6	16.6
45-49	9.8	8.5
50-54	11.2	10.7
55-64	20.5	14.5
65+	15.2	13.1
Median Age	48.4	43.0

*Less than 1/10 of 1%

APPENDIX 7B
USED CAR PRICES BY MARKET SEGMENT

The objective of Appendix 7B is to compare the selling prices of cars of the same vintage to determine used car depreciations by size class. The primary concern is in determining whether compacts, subcompacts, and/or intermediates depreciate at faster or slower rates than full-sized cars.

Economic inflation and the recent erratic rise in used car prices necessitate the usage of a comparative measure of used car prices that neutralizes the above factors so that the depreciation of used cars can be compared equally across several model years. In this analysis, actual selling price data of used cars are converted to a ratio so that the depreciation of the various model years can be compared. By using a ratio of the selling price of model X to that of a standard full-sized model for the same vintage cars, the depreciation of compact, subcompact, and intermediate cars can be measured and compared to the depreciation of full-sized cars.

If the ratio of the selling price of a compact car compared to the selling price of a full-sized car remains constant across all model years, it can be said that both newer and older compacts depreciate at the same rate as the full-sized car. Consequently, the demand for compacts compared to the demand for full-sized cars of the same vintage remains constant. However, if the ratio of the selling price of the compact compared to the selling price of the full-sized car increases or decreases as we go from a newer to an older model year, it can be said that compacts depreciate, respectively, at a slower or faster rate than full-sized cars. Thus, the demand for compacts compared to that for full-sized cars of the same vintage, respectively, would be higher or lower, as reflected by the higher or lower price ratios.

The basic formula for the price ratio is

$$P_{x_t} = \frac{BP_{x_t}}{BP_{s_t}} \times 100$$

where P_{x_t} = price ratio of model X for model year t,

BP_{x_t} = Book price of model X for model year t, and

BP_{s_t} = Book price of the Standard Full-sized car for model year t.

Two data bases were used to calculate and graph the price ratios of used cars. One data base dealt with the price comparisons of sedans. In that data base, the October 1, 1978 to November 14, 1978 Red Book[5] used car retail prices in Region A (Northeast) for thirteen cars which were representative of the major domestic and import auto manufacturers and four size classes were used. The popular models by each manufacturer were selected, and the cars in each size class by manufacturer were equal in body style, drivetrain, and accessories. The prices of the following 1972 model year to 1977 model year sedans in the fall of 1978 by size class and manufacturers were used in this analysis:

Subcompacts:

Ford Pinto
Chevrolet Vega
Toyota Corolla
Volkswagen Beetle

Compacts:

Ford Maverick
Chevrolet Nova
Plymouth Volare-Valiant

Intermediates:

Ford LTD II - Torino
Chevrolet Malibu-Chevelle
Plymouth Fury - Satellite

Full-Sized:

Ford LTD
Chevrolet Impala
Plymouth Gran Fury - Fury III

The used car price data obtained for these cars are presented in Table 7B-1.

The full-sized Chevrolet was the standard full-sized sedan used as the base for the ratio calculations due to its high resale value compared to Ford and Plymouth full-sized cars. The price ratio (index) was calculated by setting the full-sized Chevrolet used car price to 100 and converting the other used car prices to a ratio of the full-sized Chevrolet used car prices for each model year. The price index of used sedans is presented in Table 7B-2. From this data, Figures 7-6 through 7-9 in the text were made.

The second data base used in this section dealt with the price comparisons of station wagons. Wholesale used car prices of Zone 1 (Northeast-Midwest) "sharp" cars in the January 17, 1979 edition of Automotive Market Report[6] were used. All cars were equipped the same, and the intermediate stationwagon prices were compared to the standard-sized stationwagon prices of the same make and model year. The prices of the following 1973 to 1978 model year stationwagons were used in the analysis:

Buick	Oldsmobile
Dodge	Pontiac
Mercury	Ford
Plymouth	Chevrolet

The used car price data obtained for these cars are presented in Table 7B-2.

The base for each ratio calculation was the standard stationwagon of the same make and model year as its corresponding intermediate stationwagon. The price index of used stationwagons is presented in Tables 7B-3 and 7B-4. From these data, Figure 7-10 in the text was constructed.

TABLE 7B-1. USED CAR PRICES BY MARKET SEGMENT FOR MODEL YEARS (MY) 1972-1977 (AVERAGE RETAIL VALUE OF USED CARS IN REGION A) OCTOBER 1, 1978 TO NOVEMBER 14, 1978

MY	CHEVY STD	TOYOTA CAROLLA	VW BEETLE	CHEVY VEGA	CHEVY NOVA	CHEVY MALIBU	FORD PINTO	FORD MAVERICK	FORD LTDII TORINO	FORD LTD	VALIANT PLYMOUTH VOLARE	PLYMOUTH SATTELITE FURY	PLYMOUTH FURY III GRAN FURY
1977	4400	2575	2575	2800	3650	3950	3050	3425	4025	4375	3725	3700	3900
1976	3475	2125	2150	2225	3150	3075	2525	2950	2675	3450	2825	2925	3075
1975	2525	1750	1850	1675	2575	2375	2075	2325	2000	2575	2375	2100	2225
1974	1925	1500	1550	1325	2125	2125	1750	1850	1700	1925	1925	1825	1825
1973	1525	1175	1220	1050	1850	1575	1500	1675	1450	1500	1725	1275	1300
1972	1200	950	1000	900	1450	1500	1225	1300	1200	1150	1250	1225	1025

Source: Reference 5.

TABLE 7B-2. THE RATIO OF USED CAR RETAIL PRICES BY MARKET SEGMENT TO THE RETAIL PRICES OF FULL-SIZED CHEVROLETS FOR MODEL YEARS (MY) 1972-1977 (AS OF OCT. - NOV. 1978)

MY	CHEVY STD	TOYOTA CAROLLA	VW BEETLE	CHEVY VEGA	CHEVY NOVA	CHEVY MALIBU	FORD PINTO	FORD MAVERICK	FORD LTDII TORINO	FORD LTD	VALIANT PLYMOUTH VOLARE	PLYMOUTH SATTELITE FURY	PLYMOUTH FURY II GRAN FURY
1977	1.00	.59	.59	.64	.83	.90	.69	.78	.91	.99	.85	.84	.89
1976	1.00	.61	.62	.64	.91	.88	.73	.85	.77	.99	.81	.84	.88
1975	1.00	.69	.73	.66	1.02	.94	.82	.92	.79	1.02	.94	.83	.88
1974	1.00	.78	.81	.69	1.10	1.10	.91	.96	.88	1.00	1.00	.95	.95
1973	1.00	.77	.79	.68	1.21	1.03	.98	1.10	.95	.98	1.13	.84	.85
1972	1.00	.79	.83	.75	1.21	1.25	1.02	1.08	1.00	.96	1.04	1.02	.85

Source: Reference 5.

TABLE 7B-3. USED CAR PRICES OF INTERMEDIATE AND STANDARD STATION WAGONS (OCT. 1, 1978 TO NOV. 14, 1978)

MY	BUICK		CHEVROLET		DODGE		FORD	
	INT.	STAND.	INT.	STAND.	INT.	STAND.	INT.	STAND.
1978	$4856	$5837	$4518	$5435	$4384	$4906	-	$5586
1977	4062	4791	3778	4329	3367	3891	3911	4494
1976	3254	3464	3096	3229	2671	2819	2754	3453
1975	2634	2808	2559	2647	2130	2226	2211	2830
1974	2053	2000	2053	1872	1612	1570	1806	1817
1973	1634	1539	1507	1342	1328	1099	1403	1318

MY	MERCURY		OLDSMOBILE		PLYMOUTH		PONTIAC	
	INT.	STAND.	INT.	STAND.	INT.	STAND.	INT.	STAND.
1978	-	$5893	$4978	$5837	$4384	-	$4737	$5559
1977	$3833	4671	4387	4843	3364	3892	3892	4428
1976	2676	3357	3617	3491	2671	2826	3043	3238
1975	2121	2855	2968	2826	2128	2255	2498	2510
1974	1740	1985	2446	2010	1645	1543	2065	1853
1973	1366	1499	1865	1551	1316	1133	1432	1273

SOURCE: Reference 6.

TABLE 7B-4. USED CAR PRICES OF INTERMEDIATE STATION WAGONS NORMALIZED TO USED CAR PRICES OF STANDARD STATION WAGONS OF SAME MAKE AND MODEL YEAR (AS OF OCT. - NOV. 1978)

MY	BUICK %	CHEVROLET %	DODGE %	FORD %
1978	83.2	83.1	89.4	-
1977	84.8	87.3	86.5	87.0
1976	93.9	95.9	94.7	79.8
1975	93.8	96.7	95.7	78.1
1974	102.7	109.7	102.7	99.4
1973	106.2	112.3	120.8	106.4

MY	MERCURY %	OLDSMOBILE %	PLYMOUTH %	PONTIAC %
1978	-	82.3	-	85.2
1977	82.1	90.6	86.4	97.9
1976	79.7	103.6	94.5	94.0
1975	74.3	105.0	94.4	99.5
1974	87.7	121.7	106.6	111.4
1973	120.2	120.2	116.2	112.5

SOURCE: Reference 6.

APPENDIX 7C
"REQUIRED" SALES

"Required" sales is an estimate of the number of vehicles that must be sold in the United States to maintain current or base year life style. To determine this sales level, current or base year age-specific motor vehicle scrappage rates are assumed to hold in the future. The "required" sales are the difference between the vehicle registrations necessary to maintain current or base year life style, and the current or base year registrations less the scrappage. To determine what a future vehicle registration level should be, under constant life style assumptions, a constant level of vehicles per household is assumed. Future vehicle registration levels are then the projected number of households multiplied by the assumed vehicles per household (Table 7C-1).

TABLE 7C-1. VEHICLES PER HOUSEHOLD

Date	Vehicle Type	Number of Vehicles	Number of Households	Vehicles/HH
7/1/77	Cars	99,903,594 (1)	74,601,000 (2)	1.339
7/1/78	Cars	102,450,000 (e)	76,500,000 (3)	1.339 (a)
7/1/77	Light Trucks	28,221,661 (1)	74,601,000 (2)	0.378
7/1/78	Light Trucks	28,940,000 (e)	76,500,000 (3)	0.378 (a)

(1) Source: Reference 11.

(2) Source: Census Report P, 7/77

(3) Extrapolated from Census Data Report P, 3/78, as Households (7/78)=Household (3/78) x (Households (7/77) ÷ Households (3/77)

(a) Assumed

(e) Estimated

For a given year, age-specific survival rates are computed as follows: The age of the vehicle is estimated as the beginning of the given year minus the model year, i.e., if the given year is 1975-1976, a model year 1973 vehicle is a two-year old vehicle. The survival rate of vehicles age X is estimated as the number of model year 1975-X vehicles at the end of the given year, divided by the number of model year 1975-X vehicles at the end of the given year, i.e., in 1976 for the above example.

The last years for which vehicle registration data exists are July 1, 1976 to July 1, 1977. Age-specific survival rates for this period are shown in Table 7C-2 along with July 1, 1977 fleet registrations.

TABLE 7C-2. VEHICLE SURVIVAL RATES AND REGISTRATIONS

Age	Age-Specific Survival Rate July 1, 1976-July 1, 1977[1]		Fleet as of July 1, 1977[2]	
	Cars	Light Trucks	Cars	Light Trucks
0	1.00000	1.000000	7,176,880	2,177,100
1	0.97319	0.997263	9,557,278	2,745,353
2	0.98446	0.982702	7,477,202	2,109,269
3	0.97525	0.983893	9,594,193	2,688,484
4	0.96871	0.981213	10,854,200	2,752,174
5	0.95351	0.980324	9,562,731	2,291,358
6	0.93507	0.972690	7,865,782	1,639,154
7	0.89565	0.964228	7,449,104	1,572,510
8	0.85454	0.958256	6,962,971	1,644,761
9	0.82368	0.948148	5,858,627	1,266,971
10	0.79521	0.944172	4,415,659	1,128,791
11	0.77057	0.936307	3,887,297	1,095,919
12	0.76375	0.921918	3,023,012	921,850
13	0.75565	0.908726	1,969,035	736,421
14	0.75505	0.903016	1,314,634	565,545
15	0.84748	0.863289	2,092,705	2,864,656
TOTAL				

(1) Computed from data in Reference 11.

(2) Source: Reference 11.

To estimate the number of vehicles surviving in the fleet from July 1, 1977 to July 1, 1978, the age-specific scrappage rates for vehicles age X are multiplied by the number of vehicles age X in the July 1, 1977 fleet and the results are summed over all X=0,1,2,3,...14,15+. The results of this calculation are shown in Table 7C-3.

TABLE 7C-3. "REQUIRED" VERSUS ACTUAL SALES, JULY 1, 1977-JULY 1, 1978

	VEHICLES SURVIVING	"REQUIRED" FLEET SIZE	"REQUIRED" SALES	ACTUAL SALES
Cars	91,386,131	102,450,000	11,064,000	9,234,532
Light Trucks	27,131,874	28,940,000	1,808,000	3,556,182
TOTAL	118,518,005	131,387,000	12,872,000	12,790,714

Subtracting vehicles surviving from the required fleet size yields the required sales for July 1, 1978. These data are shown in Table 7C-3 and are compared with the actual sales during the period July 1, 1977 to July 1, 1978.

8. LARGE STATION WAGON DEMAND*

8.1 INTRODUCTION

In response to the fuel economy standards, motor vehicle manufacturers have downsized their station wagons and passenger cars. In the case of the downsized large station wagon, the question is whether or not consumers are shifting their purchases from large station wagons to vans and pickups. If this type of shift is occurring, does it negate the impact of AFER? This section also discusses the changes in sales trends, market shares, and fuel economy of the large station wagons with respect to the sales, share, and fuel economy of vans and pickups.

8.2 MAJOR FINDINGS

- The decline in large station wagon sales and the rise in van sales antedates fuel economy legislation.
- Large station wagon sales have been diverted to both medium sized station wagons and to vans. The former involves fuel savings; the latter involves fuel losses.
- Even on the basis of very conservative estimates, the diversion to medium sized station wagons has been sufficient to offset any fuel losses due to the diversion to vans.

8.3 STATION WAGON SALES

To analyze sales, it is best to use retail sales. Unfortunately, the automobile industry ceased to publish retail sales data by body style in the mid-1970s. Currently, the best available proxy data are new car registration data. This analysis has relied on the new car registration data released by R.L. Polk & Co. to

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*This section covers large station wagon demand trends between 1970 and 1978. The primary research was performed in March, 1979.

Ward's Automotive Yearbook and Automotive News. The size classes used in the analysis are EPA's for the recent years, and follow EPA guidelines for the older years.

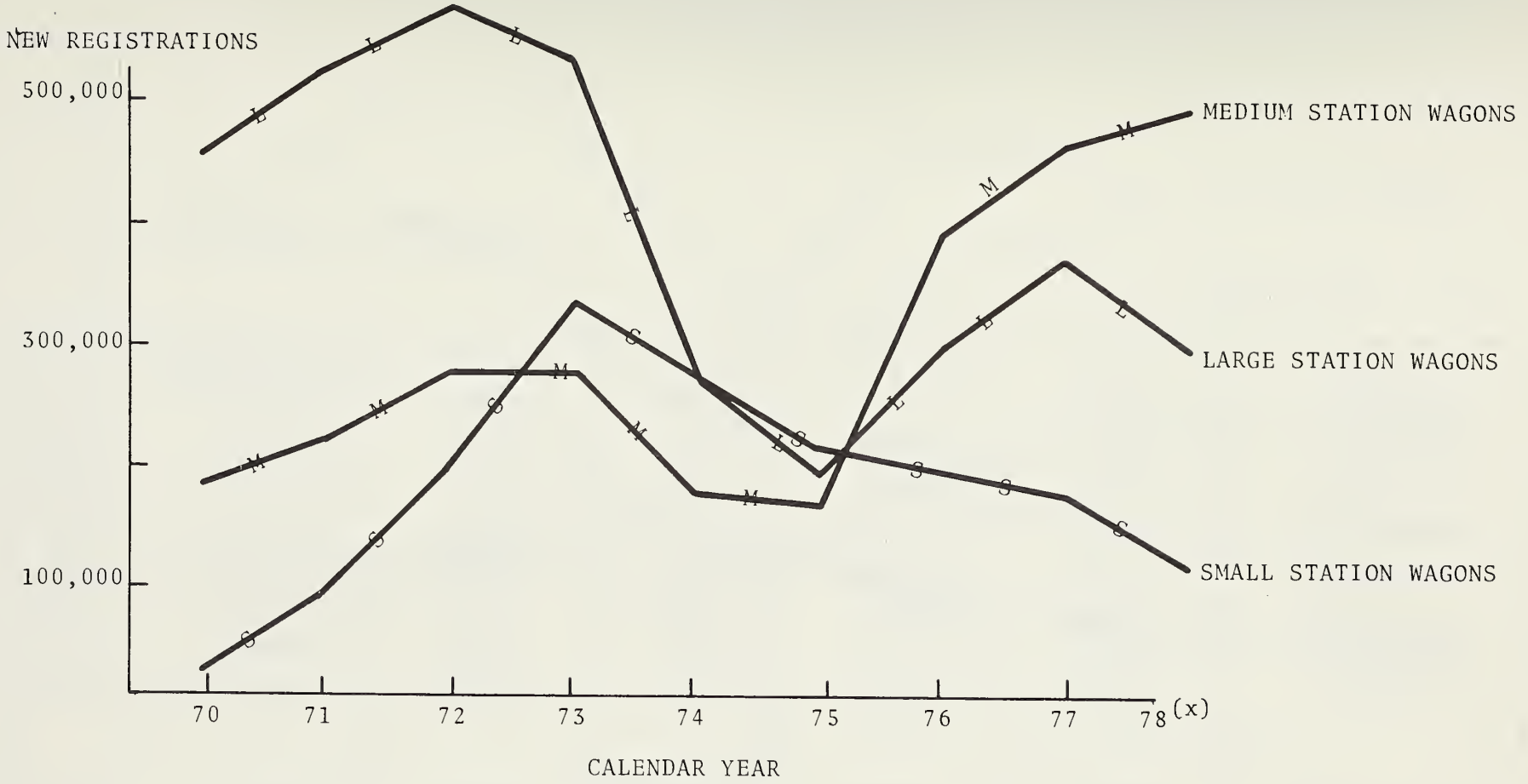
Figure 8-1 and Table 8-1 show the new station wagon registrations by size classes since 1970. Sales of large station wagons peaked in 1972, three years before the passage of AFER. In 1972, about 580,000 large station wagons were sold. After 1972, sales declined sharply through 1975. There was a recovery of sales in 1976 and 1977, followed by a decline in 1978, which returned sales roughly to their 1976 level of 300,000 units.

In the beginning of the decade, sales of medium sized station wagons were roughly half those of large sized station wagons. However, after the 1973 oil embargo, these sales declined far less sharply than the sales of the large station wagons.

In the period 1975 to 1978, sales of medium sized station wagons rose steadily and have now reached the 500,000 units per year sales level of the large station wagons prior to 1973.

The small domestic and captive import station wagons had a sharp rise in sales during the early 1970's, peaked in 1973, and have been on a steady decline ever since. Since these small station wagons compete head-on with the station wagons of the major imports, it is not clear if the decline in domestic small station wagons is due to import competition or due to disenchantment with this body style.

The sale of station wagons is, in general, subject to the same economic pressures and cycles as the sale of other motor vehicles. To normalize the economic impact, Figure 8-2 and Table 8-2 investigate the market shares of station wagons rather than their actual sales. Figure 8-2 shows that the new registration losses for medium sized and large station wagons between 1972 and 1975 were accompanied by market share losses. During the 1976 and 1977 recovery of passenger car sales, both the large and medium sized station wagons gained market share. With the decline in large station wagon sales in 1978, the large station wagons lost market



(x) 11 Month data-upseated to annual data.

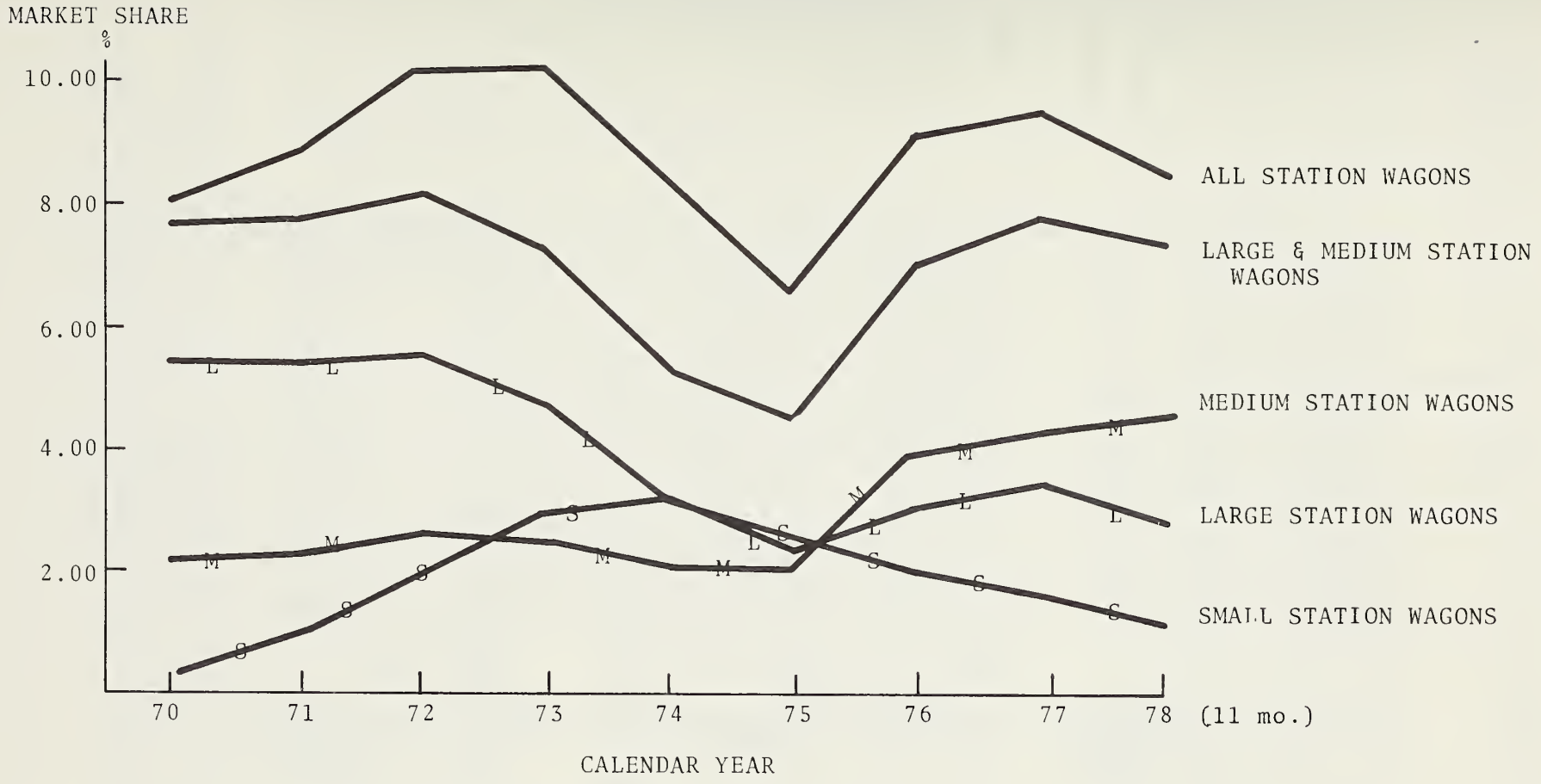
Source: Reference 1.

FIGURE 8-1. NEW STATION WAGON REGISTRATIONS, (Domestic and Captive Imports)

TABLE 8-1. NEW REGISTRATIONS OF DOMESTIC AND CAPTIVE IMPORT STATION WAGONS

CALENDAR YEAR	SMALL	MEDIUM	LARGE	MEDIUM AND LARGE	ALL STATION WAGONS	TOTAL NEW CAR REGISTRATIONS
1970	30,036	186,333	456,343	642,681	672,717	8,338,204
1971	98,517	225,521	528,602	754,123	862,640	9,729,109
1972	205,657	280,218	578,161	858,379	1,064,036	10,487,794
1973	336,683	283,786	539,627	823,413	1,160,096	11,350,995
1974	277,359	183,680	276,603	460,283	737,642	8,701,094
1975	216,609	174,704	200,887	375,591	592,200	8,261,340
1976	198,134	393,647	302,197	695,844	893,978	9,751,485
1977	178,075	470,706	374,776	845,482	1,023,557	10,751,924
1978 (11 mo.)	112,335	457,490	278,240	735,730	848,075	9,997,568

Source: Reference 1.



Source: Reference 1.

FIGURE 8-2. MARKET SHARE OF DOMESTIC CAR CAPTIVE IMPORT STATION WAGONS BY SIZE CLAS (Share of Total New Car Registrations)

TABLE 8-2. MARKET SHARE OF DOMESTIC AND CAPTIVE IMPORT STATION WAGONS BY SIZE CLASS
(Percent of Total New Car Registrations)

CALENDAR YEAR	SMALL	MEDIUM	LARGE	MEDIUM & LARGE	ALL
1970	.36	2.22	5.44	7.66	8.02
1971	1.01	2.32	5.43	7.75	8.76
1972	1.96	2.67	5.51	8.18	10.14
1973	2.97	2.50	4.75	7.25	10.22
1974	3.19	2.11	3.18	5.29	8.48
1975	2.62	2.11	2.43	4.54	7.16
1976	2.03	4.04	3.10	7.14	9.17
1977	1.66	4.38	3.49	7.87	9.53
1978 (11 mo.)	1.12	4.58	2.78	7.35	8.48

Source: Based on Reference 1.

share, and this loss is not fully offset by the market share gains of the medium sized station wagons.

8.4 VAN SALES

Van factory sales* (Figure 8-3 and Table 8-3) have risen every year since 1970, except for the 1975 recession year. The growth rate since passage of AFER has been about the same as that prior to the 1974-1975 recession. In 1978, there were about 850,000 passenger and truck van sales.[2] This compares to about 300,000 large station wagon sales, and 925,000 domestic and captive import station wagon sales.

8.5 FUEL ECONOMY OF STATION WAGONS AND VANS

The average fuel economy of station wagons, vans, and standard pickup trucks is shown in Table 8-4. This table indicates that a shift from a large station wagon to a pickup truck or a van with manual transmission would, on the average, entail no fuel economy penalty. A shift to vans with automatic transmission would entail, on the average, a fuel penalty of .6 miles per gallon. If one assumes a vehicle life of 100,000 miles, then, a van with automatic transmission would consume 302 gallons more than a large station wagon. The station wagon would use 6,944 gallons, the van 7,246 gallons.

The station wagon sales figures indicate that, during the 1970's, many large station wagon owners shifted to medium-sized station wagons. On the average, such a shift increases the fuel economy by 2.1 miles, and lowers the life time fuel consumption to 6,061 gallons, or a saving of 883 gallons. If large station wagons were no longer produced, and if 25 percent of the

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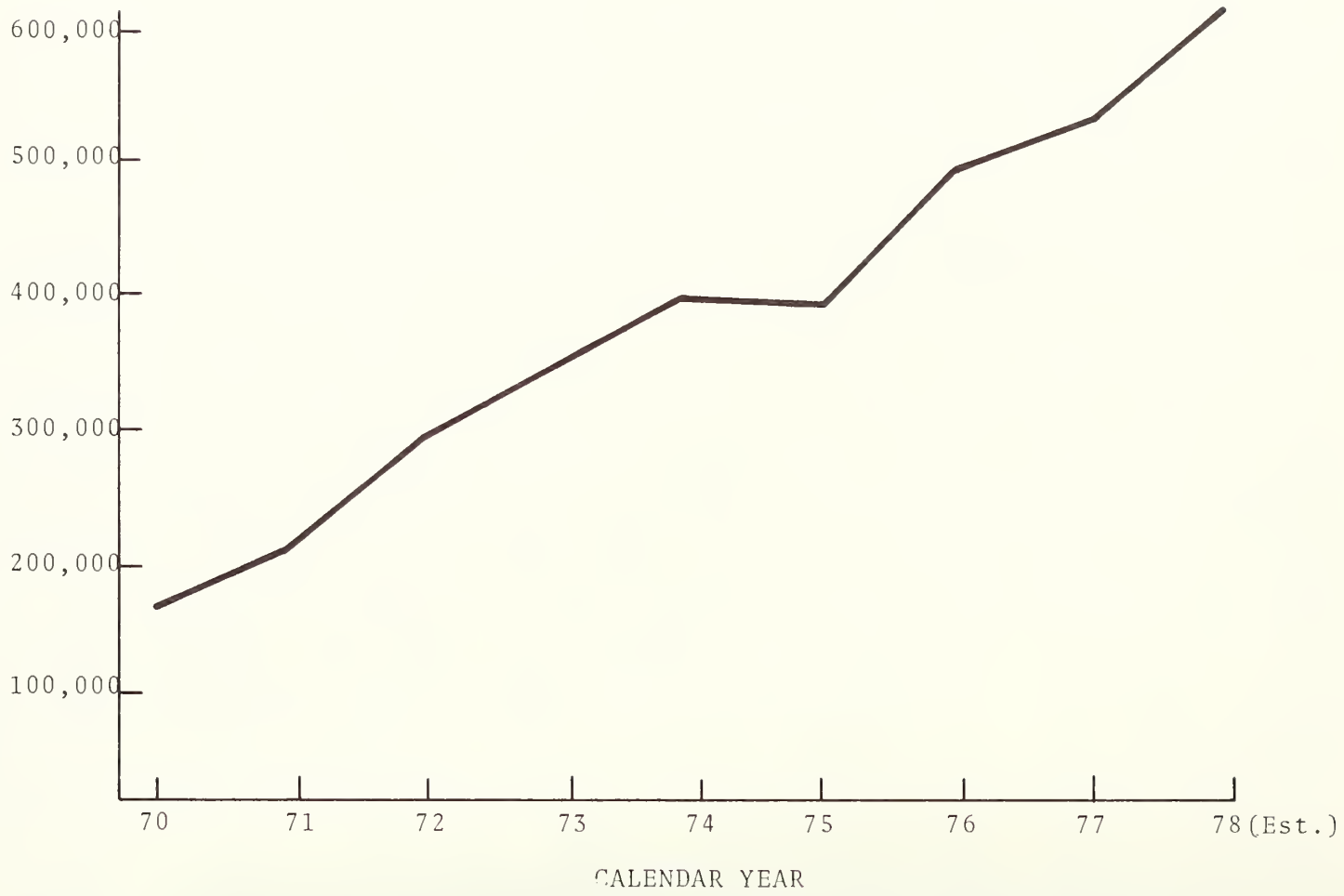
*In the absence of consistent consolidated statistics on retail van sales for the early 1970's, this analysis relies on U.S. factory sales. These sales, which include export sales, are usually lower than retail sales, which include the vans manufactured in Canada and sold in the United States.



Source: Reference 3.

FIGURE 8-3. VAN FACTORY SALES

TABLE 8-3. VAN FACTORY SALES

CALENDAR YEAR	NUMBER
1970	169,081
1971	212,344
1972	298,652
1973	343,423
1974	391,414
1975	382,813
1976	490,849
1977	526,612
1978	593,439

Source: Reference 3.

TABLE 8-4. AVERAGE FUEL ECONOMY OF STATION WAGONS, VANS AND STANDARD PICKUP TRUCKS

VEHICLE CLASS*	MPG**
Medium Station Wagons - All	17.1
Medium Station Wagons - Automatic Transmissions	16.5
Standard Pickup Trucks - All	15.3
Vans - All	15.0
Standard Pickup Trucks - Automatic Transmissions	14.5
Large Station Wagons*** - Automatic Transmissions	14.4
Vans - Automatic Transmissions	13.8

* All vehicles have gasoline engines. Diesel powered vehicles were excluded from this analysis.

** Average (harmonic mean) miles per gallon for vehicles in class by type. Average is not sales weighted.

*** All large station wagons listed by EPA have automatic transmissions.

Source: Reference 4.

prospective large station wagon buyers shifted to medium sized station wagons and 75 percent shifted to vans, there would be neither a fuel savings nor a fuel loss.

Between 1972 and 1978, large station wagon sales dropped by roughly 275,000 units. During the same period, medium-sized station wagons increased their annual sales by 220,000 units. If we assume that the drop in large station wagon sales was made up by shifts to medium sized station wagons and to vans, and that these shifts resulted in no fuel loss and no fuel saving, roughly 70,000 potential large station wagon buyers must have shifted to medium sized station wagons. Such a shift accounts for less than one-third of the rise in medium sized station wagon sales. Thus, it appears that the decline in large station wagon sales since 1972 has more likely caused fuel savings than fuel losses.

The conclusion that there is a consumer preference for medium sized station wagons compared to large station wagons can further be substantiated from the used car prices of medium sized and large station wagons (see Section 7).

8.6 REFERENCES FOR SECTION 8

1. "New Car Registration Data," R.L. Polk & Co.

2. "Motor Vehicle Sales and Prices," U.S. Department of Transportation, Transportation Systems Center, Memorandum, December, 1978.

3. "Motor Vehicle Facts and Figures," Motor Vehicle Manufac - turers Association, 1976, 1978, and 1979.

4. "1979 Gas Mileage Guide," U.S. Department of Energy.

9. CONSUMER EXPENDITURES *

9.1 INTRODUCTION

This section examines the 1970s' trends in consumer expenditures for motor vehicle purchases and related goods and services from a framework including household income, prices, and financing.

9.2 MAJOR FINDINGS

Since the household is the relevant economic unit when dealing with motor vehicles and related expenditures, these findings focus on income and expenditures by households.

- Since 1970, real median household income has stagnated. There was a slight advance in real mean household income.
- Despite no real income gains, households increased their expenditure allocations to private motor vehicle transportation from 11.7 percent of all expenditures in 1971 to 13.7 percent in 1978.
- For new cars, households allocated less of their expenditures in 1978 than in 1972 and 1973. In these years, households increased their allocations for used cars and "other motor vehicles."
- In 1978, households allocated over 50 percent more of their total expenditures to repairs and maintenance than they did in 1970.
- In 1973, the latest year for which detailed data are available, the highest expenditure allocations for new and used cars were among households with median income, those located in the South, those with young family heads, those in blue collar occupations, and those with 3 persons.

*This section covers consumer expenditures between 1970 and 1978. The primary research for this section was performed in the summer of 1979.

- Gasoline expenditures accounted for the largest proportion of total income among those households with slightly above median income, those living in the South, those with young householders, those in blue collar jobs, and those with 3 persons.
- Households with blue collar civilian jobs allocated more of their expenditure for repair and maintenance than other groups. The expenditure allocations were also usually higher in the older households.
- Since 1975, the year AFER passed, private transportation prices have advanced faster than the rate of inflation. Used cars, particularly, lead this advance, while gasoline, through early 1979, trailed considerably the inflation of the post-1975 period.

9.3 INCOME AND EXPENDITURES

This analysis begins with the tenet that the household is the relevant economic unit when dealing with motor vehicles and related expenditure. Thus, much of the data will be presented on a per household basis where available.

9.3.1 Income Per Household

Table 9-1 gives the income per household and per capita income for the period 1970-77 in both current and constant dollars. Although the median, mean, and per capita incomes have increased dramatically in current dollars, these gains diminish when measured in constant dollars. Median household income has stagnated over the period 1970-77, showing no real increase. Mean household income has increased slightly, by about 3 percent. Per capita income showed a substantial increase in real terms, nearly 15 percent, over the eight year period. This growth is not reflected in the household income figures because the average household size has declined, primarily due to a reduction of the number of persons below 18 years of age per household.

TABLE 9-1. INCOME PER HOUSEHOLD AND PER CAPITA INCOME 1970-77

	Current Dollars			Constant (1977) Dollars		
	Median HH Income	Mean HH Income	Per Capita Income	Median HH Income	Mean HH Income	Per Capita Income
1970	$ 8,734	$10,001	$3205	$13,630	$15,608	$5002
1971	9,028	10,383	3389	13,509	15,536	5071
1972	9,697	11,286	3743	14,046	16,348	5422
1973	10,512	12,157	4099	14,335	16,578	5590
1974	11,197	13,094	4458	13,759	16,090	5478
1975	11,800	13,779	4767	13,286	15,514	5367
1976	12,686	14,922	5220	13,504	15,885	5557
1977	13,572	16,100	5730	13,572	16,100	5730
Percent Change						
1970-71	3.4	3.8	5.7	*-0.9	*-0.5	1.4
71-72	7.4	8.7	10.4	4.0	5.2	6.9
72-73	8.4	7.7	9.0	2.1	1.4	3.1
73-74	6.5	7.7	8.8	-4.8	-4.4	-3.6
74-75	5.4	5.2	6.9	-3.4	-3.6	-2.0
75-76	7.5	8.3	9.5	1.6	2.4	3.5
76-77	7.0	7.9	9.8	* 0.5	1.4	3.1
Total 1970-77	55.4	61.0	78.8	* 0.4	3.2	14.6

*Indicates a statistically insignificant change at 95% confidence level.

Source: Reference 1.

The median and mean household incomes show the same trend when measured in constant dollars. They increased annually from 1970 to their peak in 1973, and then, coincident with the first OPEC price shock and ensuing recession, fell markedly in 1974 and 1975. Median household income rose back to its 1970 level in the following two years, and mean household income recovered enough from its decline to show an overall 3 percent improvement over 1970. Per capita income reached a local maximum in 1973, declined in 1974 and 1975, but recovered more strongly in the next two years to be at its highest level ever by 1977.

9.3.2 Personal Consumption Expenditures

Despite no real income gains, households have increased their ownership of motor vehicles throughout the 1970's (see Part III, Section 4). This section is an analysis of the expenditure patterns for personal consumption in this decade.

9.3.2.1 Gross Classifications - Table 9-2 shows the breakdown of total personal consumption expenditures for the years 1970-78. Several trends are discernible. Households have increased the share of their expenditures allocated for user operated transportation from 11.7 percent to nearly 14 percent by 1978. In the first quarter of 1979, this percentage was still climbing.[2] Medical expenditures also increased substantially, with smaller increases given to spending on housing, household operation, and recreation. The major losers in this redistribution of expenditure patterns were food and clothing. Food expenditures dropped 1.5 percent, and spending on clothing a larger 2.4 percent. Personal business, personal care, private education, religious and welfare, and net foreign travel expenditures all declined by smaller amounts. Since the average household had fewer children in 1978 than in 1970, it is not surprising that clothing and food reductions were the means by which user operated transportation and medical expenditures were increased without a commensurate

TABLE 9-2. PERSONAL CONSUMPTION EXPENDITURES
BY EXPENDITURE CATEGORIES
1970-1978 IN PERCENT

Type	1970	1971	1972	1973	1974	1975	1976	1977	1978p
Food and Tobacco	22.9	22.1	22.2	22.4	22.9	22.9	22.2	21.7	21.4
Clothing	10.2	10.1	8.8	8.9	8.6	8.4	8.1	7.9	7.8
Personal Care	1.7	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.4
Housing	14.7	14.9	15.3	15.2	15.3	15.3	15.3	15.3	15.5
Household Operations	14.1	14.1	14.3	14.5	14.7	14.5	14.6	14.7	14.6
Medical Service	7.7	7.8	8.3	8.4	8.6	9.1	9.6	9.8	9.8
Personal Business	5.7	5.7	5.1	5.0	5.1	5.3	5.1	5.0	4.9
Transportation	12.6	13.6	13.8	13.7	12.9	12.8	13.8	14.3	14.4
(User Operated Transportation)	11.7	12.7	13.0	12.9	12.1	12.0	13.0	13.5	13.7
Recreation	6.6	6.4	6.7	6.8	6.8	6.8	6.7	6.7	7.0
Private Education	1.7	1.6	1.6	1.6	1.5	1.6	1.6	1.6	1.5
Religious	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.2
Foreign Travel, Other	.8	.8	.8	.6	.6	.5	.4	.4	.4
Total Personal Consumption Expenditures	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Reference 3.

increase in real household income.

9.3.2.2 User Operated Transportation Expenditures Per Household - Table 9-3 gives the user operated transportation expenditures per household by category in both current and constant dollars. Table 9-4 shows the expenditure breakdown by percentages. These data should be examined in three segments: 1970-73, pre-OPEC oil price quadrupling; 1974-75, recession; and 1976-78, recovery.

The period 1970-73 was one of early recession and then strong recovery. Median and mean household incomes in constant dollars showed no change from 1970 to 1971, but rebounded for gains of 6 percent and 7 percent, respectfully, in 1972-73. (Table 9-1). Median and mean household incomes were at their greatest level ever in 1973, and consumers responded with their largest expenditures, in real terms, for new and used autos and for gasoline and oil. The average household expended $602.30 for new and used autos and $364.60 for gas and oil. In addition, expenditures for tires, tubes, and accessories and user operated transportation services increased in real terms throughout the period. (Table 9-3). In looking at the expenditure percentages of Table 9-4, it can be seen that the portion of personal consumption expenditures allocated by each household, in current dollars, for user operated transportation increased from 11.7 percent to 12.9 percent. Of the subdivisions, the category showing the most volatility was for the portion of income spent on repairs, which increased from 1.4 percent to 1.9 percent. This is probably because of the public's increased holdings of used autos which require more frequent repair. (See Section 4.5). Percentage expenditures for insurance premiums less claims showed a 33 percent increase (from 0.6 percent to 0.8 percent) from 1970 to 1973. Expenditures in all other categories remained essentially constant as a percentage of total expenditures.

The years 1974 and 1975 were characterized by disruption in the U.S. (and world) economy. OPEC's quadrupling of crude oil prices and global crop failures combined to fuel a rampant

TABLE 9-3. PERSONAL CONSUMPTION EXPENDITURE PER HOUSEHOLD IN CURRENT AND CONSTANT (1972) DOLLARS

Type	1970	1971	1972	1973	1974	1975	1976	1977	1978
Total Expenditures (Current Dollars)	9,531	10,001	10,733	11,586	12,494	13,430	14,713	15,875	17,247
Transportation	1200.2	1356.7	1485.2	1586.0	1616.4	1721.4	2029.7	2264.5	2491.1
(User Oper. Trans.)	1115.0	1269.1	1396.0	1492.4	1513.1	1616.7	1915.2	2140.2	2354.3
New Auto	487.6	604.6	470.1	494.1	386.5	411.9	529.2	608.7	651.3
Net Used Auto			106.9	119.6	123.9	139.8	187.1	204.0	221.1
Other MV			79.9	84.4	66.4	77.9	119.9	134.6	148.6
Tires, Tubes, Acces.	88.0	94.4	83.3	91.6	97.1	102.9	112.6	124.9	133.9
Repair	134.6	144.3	203.8	220.5	247.3	279.7	312.1	340.6	375.2
Gasoline and Oil	342.8	352.3	364.3	397.9	511.7	542.0	577.9	611.3	658.8
Bridge and Road Tolls	8.4	8.7	10.9	11.2	10.7	10.9	11.5	11.6	11.8
Ins. Premiums less Claims	53.7	64.7	76.8	87.5	69.4	51.7	72.7	104.5	153.7
Numbers of Households (millions)	64.8	66.7	68.3	69.9	71.2	72.9	74.1	76.0	77.7*
Total Expenditures (Constant Dollars)**	10,245	10,347	10,733	10,983	10,684	10,625	11,057	11,285	11,476
New and Net Used Auto	492.9*	587.1*	577.0	602.3	466.9	456.3	543.1	584.6	582.7
Other MV			79.9	84.4	62.8	67.6	96.5	104.6	107.3
Tires, Tubes, Acces.	75.7	79.2	83.3	94.3	93.5	90.5	93.3	100.5	103.5
Gas and Oil	347.0	351.5	364.3	364.6	346.2	342.9	350.6	349.2	361.7
User-Operated Transportation Services	288.6	290.0	291.5	302.0	305.0	305.5	307.2	313.7	342.0

*Estimate

**U.S. Dept. of Commerce, Bureau of Economic Analysis uses different constant dollar corrections for each expenditure category. The constant dollar columns are therefore not additive.

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis - Printout, the 1978 figures are preliminary.

TABLE 9-4. PERSONAL CONSUMPTION EXPENDITURES PER HOUSEHOLD
PERCENT OF TOTAL EXPENDITURES (1970-1978)

	1970	1971	1972	1973	1974	1975	1976	1977	1978p
Total Expenditures	100	100	100	100	100	100	100	100	100
Transportation	12.6	13.6	13.8	13.7	12.9	12.8	13.8	14.3	14.4
(User Operated Transp.)	11.7	12.7	13.0	12.9	12.1	12.0	13.0	13.5	13.7
New Cars			4.4	4.3	3.1	3.1	3.6	3.8	3.8
Net Used Cars	5.1	6.0	1.0	1.0	1.0	1.0	1.3	1.3	1.3
Other Motor Vehicles			.7	.7	.5	.6	.8	.8	.9
Tires, Tubes, Access.	.9	.9	.8	.8	.8	.8	.8	.8	.8
Repair and Maintenance	1.4	1.4	1.9	1.9	2.0	2.1	2.1	2.2	2.2
Gasoline and Oil	3.6	3.5	3.4	3.4	4.1	4.0	4.0	3.9	3.8
Bridge Tolls	.1	.1	.1	.1	.1	.1	.1	.1	.1
Insurance Premiums Less Claims	.6	.6	.7	.8	.6	.4	.5	.7	.9

Source: Reference 3.

"stagflation" - rising prices and soaring unemployment in a recessionary economy. U.S. unemployment jumped more than 50 percent to a post-WWII high of 8.5 percent in 1975 (Table 9-5), and double-digit inflation appeared (Table 9-6). Mean and median household income each fell by about 8 percent in real terms (Table 9-1). Expenditures in constant dollars fell sharply in nearly all categories of user operated transportation, with only user operated transportation services showing a slight increase (Table 9-3). Looking at the percentage expenditures, we see user operated transportation expenditures fell from 12.9 percent to 12 percent of total expenditures. Spending on new autos fell from 4.3 percent to 3.1 percent of total spending, but used car expenditures remained constant. In line with this, spending on repairs increased again to account for 2.1 percent of the total. However, gasoline and oil expenditures showed the largest increase due to OPEC's huge oil price increases. In 1974 and 1975, the average household allocated a full 4 percent of its current dollar consumption expenditures for gasoline and oil. This represents a 20 percent increase (3.4 percent to 4.1 percent) over previous years. With the exception of insurance premiums less claims, which fell by 50 percent from 1973 to 1975, other categories showed no significant changes.

Beginning in 1976, the domestic economy entered a strong recovery phase. Price increases remained high by historical standards, but were only moderate when compared to the 11 percent inflation of several years earlier (Table 9-6). Unemployment fell as a record number of Americans found work in the expanding economy (Table 9-5). Median household income increased back to its 1970 level, although still well below the 1973 record high. Mean household income gained 4 percent. (Table 9-1). From Table 9-3, we see that constant dollar expenditures increased sharply for new and used autos, other motor vehicles, tires, tubes, and accessories, and for user operated transportation services. From 1976 on, gasoline and oil is the only category showing no real increase in expenditures. In percentage of current dollar expenditures (Table 9-4), user operated

TABLE 9-5. UNEMPLOYMENT IN THE UNITED STATES, YEARLY PERCENT CHANGE BETWEEN 1970 AND 1978

	Unemployment rate								
	1970	1971	1972	1973	1974	1975	1976	1977	1978
% of All Workers	4.6	5.9	5.6	4.9	5.6	8.5	7.7	7.0	6.0
	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	
% Change	47.5	-5.1	-12.5	14.3	51.8	-9.4	-9.1	-14.3	

Source: Reference 4.

TABLE 9-6. CONSUMER PRICE INDEX TOTAL AND YEARLY PERCENT CHANGE 1970 TO 1978

	1970	1971	1972	1973	1974	1975	1976	1977	1978
All Items (1967=100)	116.3	121.3	125.3	133.1	147.7	161.2	170.5	181.5	195.3
	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	
% Change	4.3	3.3	6.2	11.0	9.1	5.8	6.5	7.6	

Source: Reference 4.

transportation's share increased from the recession-low of 12 percent to 13.7 percent by 1978. Expenditures for used autos increased by 30 percent, from 1.0 percent to 1.3 percent of the total. New auto spending increased more slowly, from 3.1 percent to 3.8 percent, or by 23 percent. Repair spending increased slightly again, as households sought to maintain their larger holdings of used cars. Other motor vehicle expenditures increased by 50 percent, from .6 percent to .9 percent of the total, reflecting the consumer's shifting tastes from the traditional auto and more toward light trucks and four wheel drive vehicles. Spending on gasoline and oil decreased from 4.0 percent to 3.8 percent as the OPEC price increases slowed. Spending on tires, tubes, and accessories and bridge and road tolls remained constant. Insurance premiums less claims increased by 80 percent from 1976 to 1978, jumping from .5 percent to .9 percent of total expenditures.

9.3.3 Current Consumption Expenditures

Section 9.3.3 contains data on personal consumption expenditures from the national income accounts. In this section, we consider equity consequences of rising costs of gasoline, automobiles, repairs and maintenance, and finance charges through an analysis of the Bureau of Labor Statistics' decennial survey on current consumption expenditure patterns.

The latest analysis of consumer spending, conducted in 1972-73, (Table 9-7), found substantial differences in expenditure patterns of consumers with different economic and demographic backgrounds (Tables 9-8 through 9-11). Average expenditures of acquisition, gasoline, repairs and maintenance (including insurance), finance charges, and miscellaneous expenses (rentals and fees) are impacted by dissimilar family income, regional distributions, age of family head, occupational distributions, and family size.

Since transportation expenditures now account for 21 percent of the current consumption expenditures (only housing is greater)

TABLE 9-7. CONSUMPTION EXPENDITURE PATTERNS
1960-1961 and 1971-1972

COMPONENT	1960-61		1972-73[p]	
	Average Expend-iture	Percent of Total	Average Expend-iture	Percent of Total
TOTAL CURRENT CONSUMPTION	$5,054	100.0	$8,282	100.0
Food, total	1,234	24.4	1,664	20.1
Food at home	989	19.6	1,162	14.0
Food away from home	246	4.9	501	6.0
Housing, total	1,433	28.4	2,604	31.4
Shelter	664	13.1	1,362	16.4
Rent	269	5.3	572	6.9
Owned dwelling	349	6.9	719	8.7
Other shelter	46	.9	51	.6
Utilities	249	4.9	409	4.9
Household operations	253	5.0	447	5.4
Housefurnishing and equipment	266	5.3	387	4.7
Clothing materials and services	553	10.9	647	7.8
Medical care	340	6.7	528	6.4
Transportation, total	770	15.2	1,768	21.4
Private transportation	693	13.7	1,566	18.9
Public and other transportation	77	1.5	201	2.4
Recreation, personal care, education	612	12.2	952	11.4
Recreation	200	4.0	388	4.7
Personal care	145	2.9	165	2.0
Education	53	1.0	103	1.2
Reading	45	.9	48	.6
Alcoholic beverages	78	1.5	118	1.4
Tobacco	91	1.8	130	1.6
Miscellaneous	111	2.2	120	1.5

p= preliminary

Source: Reference 5.

(Table 9-7) and the long-run demand for new automobiles and gasoline is rather price inelastic, it is important to identify any segment of the population that would suffer disproportionately from higher gasoline, automobile, repairs and maintenance, or finance charge costs.

The equity aspects of gasoline price inflation are not evenly distributed. As consumer expenditures rose 73 percent for income groupings between $3,000 and $10,000, gasoline expenditures increased 133 percent (Table 9-8). For those income groups exceeding $10,000, total consumption expenditures increased 60 percent while gasoline expenditures rose 44 percent. In the lower income groups, the growth in gasoline expenditures was disproportionately more than the growth in consumption expenditures. Thus, rising gasoline prices and possible gas tax increases impose the greatest burden on those who can least afford to pay. It should be noted that these estimates include families who do not own automobiles. Consequently, gasoline expenditures for those households owning cars in the lower income groups represent an even more substantial fraction of their total consumption.

Other heterogeneous groups also showed variations in gasoline expenditures. For example, the portion of total consumption allocated to gas expenditures ranged from 5.6 percent for operatives and craftworkers to 3.3 percent for family heads over 65 and retired people. Since gasoline demand decreases with increasing owner age as annual mileage decreases, the latter two groups are impacted the least.

As with gasoline expenditures, the equity consequences of increased automobile prices are skewed (Table 9-9). According to the 1972-73 Consumer Expenditure Survey, the mean annual family expenditure for an automobile, new or used, is $705.00. For a family with an income greater than $10,000, the annual expenditure ranged from $779.00 to $1511.00. As income rises from $3,000 to $10,000, consumption expenditures rise only 73 percent while automobile expenditures increased 182 percent. Because this rate of increase of auto expenditures was substantially more than the

TABLE 9-8. MEAN GASOLINE EXPENDITURE AS A PERCENTAGE OF CURRENT CONSUMPTION EXPENDITURE

	Family Income Before Taxes	Regional Distribution	Age of Family Head	Occupation	Family Size
All Families	4.4	4.4	4.4	4.4	4.4
Under $3,000	3.6				
$3,000-$3,999	3.8				
$4,000-$4,999	4.3				
$5,000-$5,999	4.6				
$6,000-$6,999	4.7				
$7,000-$7,999	5.0				
$8,000-$9,999	5.2				
$10,000-$11,999	5.3				
$12,000-$14,999	5.4				
$15,000-$19,999	5.1				
$20,000-$24,999	4.9				
$25,000 and over	3.8				
Northeast		3.7			
Northcentral		4.5			
South		4.9			
West		4.3			
Under 25			5.0		
25-34			4.4		
35-44			4.4		
45-54			4.6		
55-64			4.5		
65 and over			3.3		
Self-employed				3.8	
Professionals				3.8	
Clerical & Sales				4.0	
Operatives				5.6	
Laborers				5.0	
Armed Forces				4.1	
Retired				3.3	
1 Person					3.4
2 People					4.2
3 People					4.7
4 People					4.6
5 People					4.5
6 People or more					4.6

TABLE 9-9. MEAN NEW AND USED AUTOMOBILE EXPENDITURE AS A PERCENTAGE OF CURRENT CONSUMPTION EXPENDITURE

	Family Income Before Taxes	Regional Distribution	Age of Family Head	Occupation	Family Size
All Families	8.9	8.9	8.9	8.9	8.9
Under $3,000	6.0				
$3,000-$3,999	5.2				
$4,000-$4,999	6.4				
$5,000-$5,999	6.3				
$6,000-$6,999	8.2				
$7,000-$7,999	8.4				
$8,000-$9,999	8.5				
$10,000-$11,999	9.9				
$12,000-$14,999	9.7				
$15,000-$19,999	9.6				
$20,000-$24,999	9.8				
$25,000 and over	9.0				
Northeast		7.4			
Northcentral		9.8			
South		9.6			
West		8.5			
Under 25			13.5		
25-34			9.1		
35-44			8.6		
45-54			9.4		
55-64			8.9		
65 and over			5.1		
Self-employed				9.8	
Professionals				8.5	
Clerical & Sales				8.3	
Operatives				10.6	
Laborers				9.0	
Armed Forces				12.8	
Retired				4.4	
1 Person					7.4
2 People					8.8
3 People					9.7
4 People					9.5
5 People					8.8
6 People or more					8.3

growth in total consumption, the lower income groups are impacted more heavily from rising automobile prices.

The equity aspects of increased automobile prices also vary among other heterogeneous groups. For occupation of family head, the share of consumer expenditures on new and used auto purchases range from 4.4 percent for the retired to 12.8 percent for the Armed Forces. If these extremes are eliminated, the mean of 9 percent closely approximates the other occupation groups. The age of the family head follows a similar consumption pattern for auto purchases. Once the extremes, under 25 and over 65, are eliminated, the mean is closely approximated by the other age groupings.

Similar to other transportation charges, the burden of increasing repair and maintenance expenditures most heavily impacts those families whose incomes are below $8,000 (Table 9-10). Consumer expenditures grow by 54 percent, but expenditures for repair and maintenance are equal to the change in total consumption. Vehicle insurance is the largest single item in repair and maintenance expenditures.

For all other economic and demographic characteristics for repairs and maintenance, there is no substantial divergence from the mean share of consumption expenditures. The share of expenditures for repair and maintenance only varies slightly by region of the country, occupation, age of family head, and family size.

The share of current consumption allocated to vehicle finance charges accounts for no more than 1.4 percent of total consumption (Table 9-11). In fact, only twice does it ever exceed 1.2 percent. Thus, the impact of vehicle finance charges on total consumer expenditures is very small. The equity impacts of finance charges are too difficult to analyze.

Table 9-7 compares the most recent survey (1972-73) to the previous one of 1960-61. It reveals that the trends of an increasing share of consumption expenditures on user operated transportation and housing, and a decreasing share devoted to food and clothing, as already discovered from an examination of recent

TABLE 9-10. MEAN REPAIR AND MAINTENANCE AS A PERCENTAGE OF CURRENT CONSUMPTION EXPENDITURE

	Family Income Before Taxes	Regional Distribution	Age of Family Head	Occupation	Family Size
All Families	4.9	4.9	4.9	4.9	4.9
Under $3,000	2.9				
$3,000-$3,999	3.8				
$4,000-$4,999	4.3				
$5,000-$5,999	4.5				
$6,000-$6,999	4.7				
$7,000-$7,999	5.1				
$8,000-$9,999	5.2				
$10,000-$11,999	5.3				
$12,000-$14,999	5.3				
$15,000-$19,999	5.4				
$20,000-$24,999	5.2				
$25,000 and over	4.8				
Northeast		4.8			
Northcentral		5.0			
South		4.9			
West		5.1			
Under 25			5.2		
25-34			4.6		
35-44			4.6		
45-54			5.3		
55-64			5.4		
65 and over			4.5		
Self-employed				4.7	
Professionals				4.8	
Clerical & Sales				4.9	
Operatives				5.5	
Laborers				5.1	
Armed Forces				4.7	
Retired				4.4	
1 Person					4.3
2 People					5.1
3 People					5.3
4 People					5.0
5 People					4.8
6 People or more					4.7

TABLE 9-11. MEAN FINANCE CHARGE EXPENDITURE AS A PERCENTAGE OF CURRENT CONSUMPTION EXPENDITURE

	Family Income Before Taxes	Regional Distribution	Age of Family Head	Occupation	Family Size
All Families	1.0	1.0	1.0	1.0	1.0
Under $3,000	0.7				
$3,000-$3,999	0.6				
$4,000-$4,999	1.1				
$5,000-$5,999	0.6				
$6,000-$6,999	1.0				
$7,000-$7,999	0.7				
$8,000-$9,999	1.2				
$10,000-$11,999	1.1				
$12,000-$14,999	1.3				
$15,000-$19,999	1.1				
$20,000-$24,999	1.2				
$25,000 and over	0.7				
Northeast		0.8			
Northcentral		1.2			
South		1.0			
West		1.0			
Under 25			1.0		
25-34			1.2		
35-44			1.0		
45-54			1.0		
55-64			0.9		
65 and over			0.8		
Self-employed				0.6	
Professionals				0.9	
Clerical & Sales				0.8	
Operatives				1.4	
Laborers				1.1	
Armed Forces				1.1	
Retired				0.7	
1 Person					0.9
2 People					0.9
3 People					1.2
4 People					1.1
5 People					1.0
6 People or more					1.0

national income accounts data, (Sections 9.3.2.1 and 9.3.2.2), are, in fact, much older trends going back nearly two decades.

9.4 PRICES

In the preceding discussion on expenditure trends, nothing has been said about prices which are inextricably related to expenditure patterns. This section presents data and an analysis of the relevant price indices.

Table 9-12 gives the consumer price indices for all items and the transportation sub-categories normalized to base year 1975, the year AFER was passed. Table 9-13 describes the transportation commodities and services that were included in the computation of the CPI as of January 1975. Figure 9-1 graphically portrays the relative movements of the indices of used cars, new cars, new cars (Q)*, gasoline, private transportation, and all items.

Several trends are evident. The new car price index was well above the composite index in 1971, but after 1975, it tracks the all items index quite closely. New car prices, which fell from 1971 to 1973, rose at a rate nearly identical to the general inflation rate after 1974. New car (Q) prices rose slightly faster than all items. On the other hand, the used car price index began with the composite index in 1971, then lagged well behind it and all other categories through 1974. However, beginning in 1974, the index for used autos rose the most sharply of all indices. The consumer turned from new cars to used cars because of eroding real purchasing power (see Section 9.3.1), and possibly because of a desire to postpone new car purchases in the introductory years of the emission controls which required the more expensive lead fuel. The gasoline index has shown the largest cumulative change. Its quick ascent is especially clear cut from 1973 to 1975, coincident with the OPEC oil embargo and quadrupling of OPEC prices. From 1975 to 1978, the gas index moderated, showing

*New car (Q) includes price increases due to quality changes as well as those due to inflation. See Appendix 9A.

TABLE 9-12. CONSUMER PRICE INDEX ANNUAL AVERAGE 1975=100

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1975 Index on 1967 = 100 Scale
All Items	64.6	68.1	72.1	75.2	77.7	82.6	91.6	100.0	105.8	112.6	121.2	161.2
Transportation	68.5	71.2	74.8	78.8	79.6	82.2	91.4	100.0	109.7	117.7	123.2	150.6
Private	68.8	71.1	74.2	77.8	78.4	81.1	91.2	100.0	109.9	117.9	123.5	149.8
New Cars	80.6	81.8	84.3	87.8	87.0	87.1	92.1	100.0	106.3	112.0	120.5	127.6
New Cars (Q)*	-	-	-	-	-	-	-	100.0	106.9	113.4	122.7	127.7
Used Cars	-	70.4	71.2	75.3	75.5	80.3	83.7	100.0	114.7	124.9	127.4	146.4
Gasoline	59.4	61.3	61.8	62.2	63.0	69.1	93.6	100.0	104.2	110.2	114.9	170.8
Repairs and Maintenance	59.7	63.5	68.3	73.2	76.5	80.5	88.8	100.0	107.4	115.3	124.9	176.6
Other Private Trans.	73.2	77.7	84.4	90.9	91.4	90.5	93.8	100.0	115.5	125.6	130.7	141.2
Public Transportation	66.0	71.1	81.0	86.8	90.4	91.3	93.3	100.0	109.8	115.0	118.4	158.6

*New car prices unadjusted for quality change. See Appendices 9A and 9B.

Source: TSC analysis from BLS statistics.

TABLE 9-13. LIST OF TRANSPORTATION COMMODITIES AND SERVICES PRICED FOR THE CONSUMERS PRICE INDEX AS OF JANUARY 1975

Groups, subgroups, Expenditure classes	Priced Items	
	Sample A	Sample B
Transportation:		
Private:		
Auto purchase	New cars:	
	Chevrolet, Impala, 4-door sedan	Chevrolet, Impala, 4-door sedan.
	Chevrolet, Chevelle, sport coupe	Ford, Pinto, 3-door sedan
	Ford, LTD, 4-door hardtop	Ford, LTD, 4-door hardtop
	Ford, Mustang II, 2-door hardtop	Chevrolet, Vega, 2-door hatchback.
	Plymouth, Gran Fury Custom, 4-door sedan	Plymouth, Valiant Duster, 2-door coupe.
	Dodge, Royal Monaco, 4-door sedan	Plymouth, Fury Custom, 4-door sedan
	American Motors, Hornet, sport wagon	Volkswagen, Deluxe, 2-door sedan
	Toyota, Corona, 4-door sedan	
	Used cars:	
	2 years old, Chevrolet and Ford	2 years old, Chevrolet and Ford
	3 years old do	3 years old, Do.
	4 years old do	4 years old, Do.
	5 years old do	5 years old, Do.
Gasoline and motor oil	Gasoline, regular and premium.	Gasoline, regular and premium.
	Motor oil, premium	Motor oil, premium.
Auto parts	Storage batteries	Tires, tubeless, new.
Automobile services:		
Auto repairs (mechanical) and maintenance	Chassis lubrication, complete	Water pump replacement
	Motor tune-up	Exhaust system repair
	Automatic transmission repair	Front end alignment.
Other automobile expenses	Auto insurance premiums, liability and physical damage	Auto insurance premiums, liability and physical damage
	Auto financing charges(1)	Auto financing charges(1)
	Auto registration fees	Auto registration fees.
	Auto operator's permits	Auto operator's permits.
	Parking fees, private and municipal	Parking fees, private and municipal.
Public transportation	Local transit fares	Local transit fares
	Taxicab fares	Taxicab fares.
	Railroad fares, coach	Railroad fares, coach.
	Airplane fares, chiefly coach	Airplane fares, chiefly coach
	Bus fares, intercity	Bus fares, intercity.

(1) Not actually priced: imputed from priced items.

Source: Reference 6.

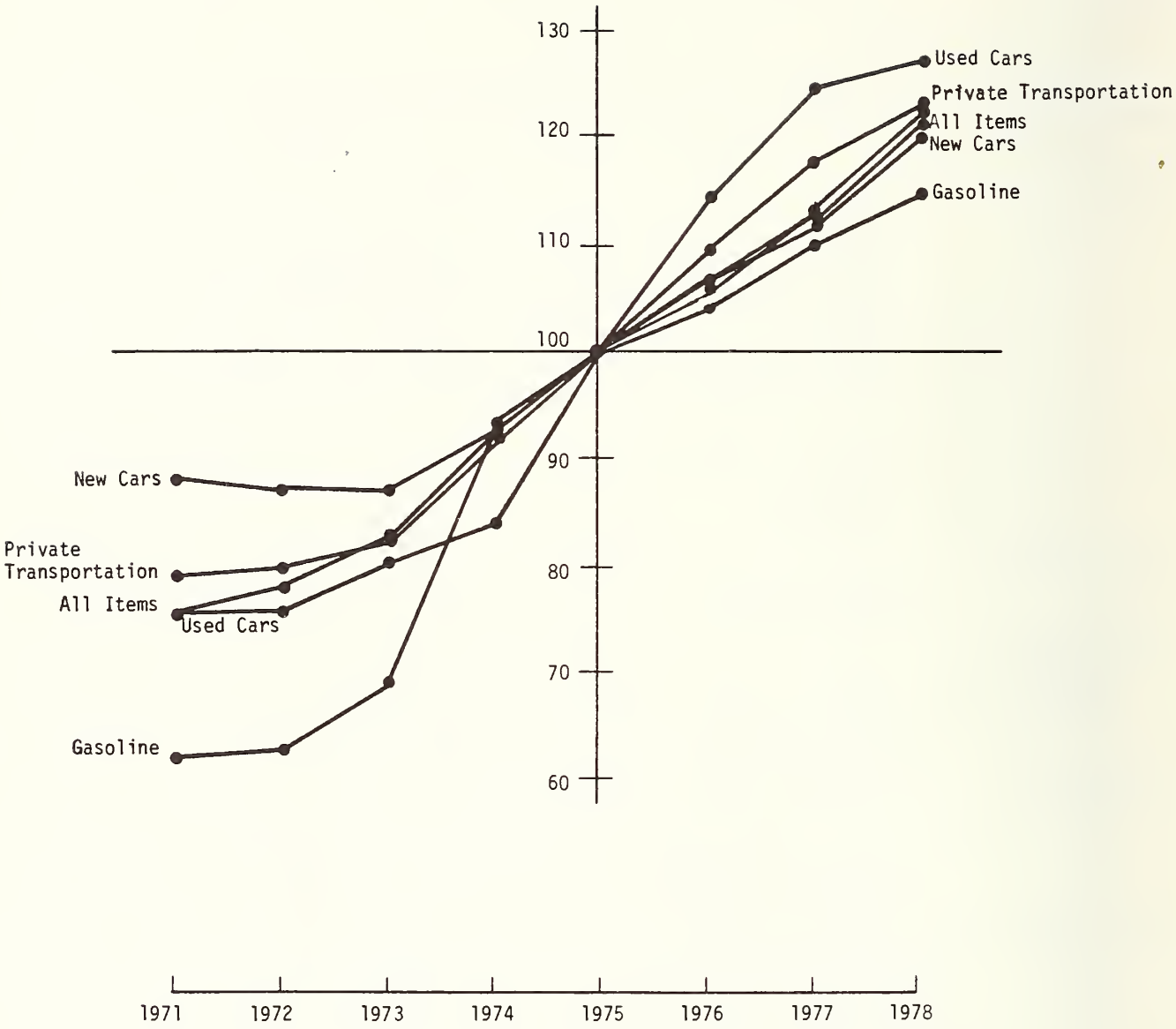


FIGURE 9-1. CONSUMER PRICE INDEX, 1975 = 100

the smallest increase of any category. However, by May 1979, gasoline prices have advanced since 1975 at a higher rate than any other component of the transportation index. Finally, the repairs and maintenance index has increased slightly faster than the general inflation rate for all items.

9.5 FINANCING

In the last nine years, households have increasingly employed credit to finance their motor vehicle purchases. Total automobile installment debt nearly tripled from 1970 to 1978 (See Table 9-14), reaching the $100 billion level in October 1978. As a percentage of personal income, automobile debt increased steadily from 1970 through 1973. The percentage dropped the next two years commensurate with the declining share of personal consumption expenditures per household devoted to new autos (See Table 9-4). From 1976 on, the percentage climbed to record levels as households revived their new auto purchases.

To carry this increased debt, households have lengthened the contract terms from an average of 34.1 months in 1974 to 40.0 months in 1978 (See Table 9-15). The average monthly new car payment has increased from $132 to $174. The percentage of longer-term contracts (3-4 years) used to finance new cars jumped from 4 percent in 1974 to a 60 percent majority by 1978. This extension of contract terms indicates that the average household will be able to return to the new car market less frequently than earlier in the 70's.

TABLE 9-14. AUTOMOBILE INSTALLMENT CREDIT (1970-78)

Year	Automobile Papers Outstanding (Billion $)	Percent of Personal Income
1970	35.2	4.4%
1971	39.4	4.6
1972	46.6	4.9
1973	52.4	5.0
1974	52.9	4.6
1975	55.9	4.5
1976	66.1	4.8
1977	79.4	5.1
1978 (Oct.)	100.2	5.9

Source: Reference 7.

TABLE 9-15. AVERAGE NEW CAR MONTHLY PAYMENT CONTRACT TERMS AND PERCENT FINANCING FOR 37-48 MONTHS (1974-1978)

	1974	1975	1976	1977	1978
Avg. Monthly New Car Payment ($)	132	146	157	163	174
Avg. Contract Term (months)	34.1	34.7	35.6	37.7	40.0
% Financing for 37-48 (mos.)	4	16	27	43	60

Source: Reference 8, GMAC data.

9.6 REFERENCES FOR SECTION 9

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2. U.S. Department of Commerce, Weekly Business Statistics, p. 2, June 29, 1979.
3. U.S. Department of Commerce, Survey of Current Business, July Issues 1973-78. 1978 data from DOC computer printout.
4. U.S. Department of Commerce, Bureau of Economic Analysis. Survey of Current Business 1972-1979.
5. Jacobs, Eva, "The Anatomy of Price Change." Monthly Labor Review. September 1977.
6. U.S. Bureau of Labor Statistics, BLS Handbook of Methods Bulletin 1910. p. 99-100, 1976.
7. Federal Reserve Bulletin, monthly 1970-78.
8. Ward's Automotive Report, Vol. 54, No. 8, February 19, 1979.

APPENDIX 9A
NEW CAR PRICES IN THE CONSUMER PRICE INDEX

An increase in the price of new cars can be divided into two increments. The first is an increase due to inflation; the second is an increase because of changes in quality. In computation of the CPI, the Bureau of Labor Statistics recognizes this and factors out the quality change price increases. This yields the "new car" price index of the CPI.

However, this can be misleading, because it does not reflect the prices that the potential purchaser actually faces when he contemplates new autos (with quality changes) on the showroom floor. Therefore, TSC has added these quality change price increases back in (See Table 9A-1) to obtain a "new car (Q)" price index for the years 1975-78. Data before 1975 are not complete enough to allow similar calculations.

In the text, "new car" price index refers to the BLS method, and "new car (Q)" price index indicates that the TSC additions are included. The BLS' method for handling quality changes is described as follows:*

Quality Changes

> "One of the most difficult conceptual problems faced in compiling a price index is accurate measurement and treatment of quality change because products and consumption patterns are constantly changing. For example, with each model change of an automobile, the BLS faces the problem of separating the price rise from the increase in price due to quality change.
>
> "Quality change in a new model of an item should not be reflected as a price change, since the index measures the cost to consumers of purchasing a constant market basket of goods and services of constant quality through time. Ideally, estimates would be obtained for each dollar value quality change resulting from a change in the model or item priced. This estimate would reflect how much consumers value the quality change.

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*U.S. Bureau of Labor Statistics: The Consumer Price Index Concepts and Content Over the Years, Report 517, 1977, p. 12.

TABLE 9A-1. PRICE INCREASES FOR PASSENGER CARS DUE TO QUALITY CHANGES

	Total Price Increase	Due to Quality Increase	% of Total Increase	News Release	
1979 Model Passenger Cars	$300.30	$46.35	15.4%	USLD78-921	Nov. 3, 1978
1978 Model Passenger Cars	$424.49	$50.12	11.8%	USDL77-967	Nov. 3, 1977
1977 Model Passenger Cars	$382.30	$59.15	15.5%	USDL76-1376	Nov. 4, 1976
1976 Model Passenger Cars	$198.00	$15.16	8.0%	USDL75-626	Nov. 6, 1975
1975 Model Passenger Cars	$386.00	$129.90	34.0%	USDL74-636	Nov. 14, 1974
1974 Model Passenger Cars	NA*	$117.90	-	USDL73-541	Nov. 7, 1973
1973 Model Passenger Cars	NA*	$123.80	-	USDL72-572	Aug. 18, 1972
1972 Model Passenger Cars	$19.00	$20.00	105.3%	USDL71-611	Nov. 18, 1971
1971 Model Passenger Cars	$226.00	$10.00	4.4%	USDL11-535	Nov. 6, 1970
1970 Model Passenger Cars	$107.00	$46.00	43.0%	USDL10-818	Nov. 18, 1969
1969 Model Passenger Cars	$40.00	$ 1.00	2.5%	USDL-9994	Oct. 7, 1968

*Not Available

Source: U.S. Department of Labor, News Releases.

"However, this direct measuring of quality change is extremely difficult since measurement of the value consumers place on quality change is rarely possible. Therefore, to adjust for quality change, BLS uses an indirect method to measure the quality change by evaluating the additional cost associated with the change in quality. For new automobile features, this estimate is based on all costs incurred in manufacturing plus the established company mark-up to the selling price of passenger cars. This estimate of costs applies to all new features that are installed as standard equipment, that is, features on cars in the same or comparable series. For all items that replace or modify some previously existing feature, the estimate is based on the difference in cost between the old and the new feature. In other words the estimate of cost for new items is computed for both the new and the old feature. the difference between these values is used as the estimate of quality change.

"Adjustments for quality change in the CPI 'new car' index include structural and engineering changes that affect safety, environment, reliability, performance, durability, economy, carrying capacity, maneuverability, comfort, and convenience. Although antipollution equipment on automobiles originally did not increase quality because the utility to the purchaser is difficult to determine, these devices do improve quality for consumers in general, and therefore an increase in physical quality for the individual consumer. Consequently, quality adjustments are made for pollution controls to automobiles.

"Quality adjustments exclude changes in style or appearance, such as chrome trim, unless these features have been offered as options and purchased by a large proportion of customers. Also, new technology sometimes results in better quality at reduced or no increase in cost. When no satisfactory value has been developed for such a change, it is ignored, and prices are compared directly. The BLS is continually researching better methods to measure quality change, but has not as yet developed a viable alternative to the present methods.

"There is great interest in whether quality change results in any bias in the CPI. An article in the Monthly Labor Review pointed out:

> 'Many economists believe that quality changes in goods and services are not adequately taken into account in the preparation of the Consumer Price Index (CPI). As a result, they believe, the CPI makes the index a questionable indicator of the course of inflationary price movements.

> 'To what extent is the belief that price indexes are biased upward borne out by existing evidence? No assessment of the quality error in the CPI as a while has yet been made, but a number of investigations have produced estimates of quality error in individual index components ... Some investigators found upward bias, but others reported that quality error might be negative--that is, when the BLS failed to correct adequately for quality changes, it resulted in a price index that rose too slowly, rather than too rapidly.'
>
> "After reviewing key studies in the field, the author concluded that there was no conclusive evidence to indicate a particular bias in the CPI due to quality change: '. . .we have not proved that price indexes are biased either upward or downward; rather, they establish only that the proposition that indexes are systematically upward-biased is not conclusively confirmed by the available evidence.'"**

The estimated quality changes in new car models 1969 through 1979 are shown in Table 9A-11.

**Jack E. Triplett, "Determining the effects of quality change on the CPI," Monthly Labor Review, May 1971, pp. 27-38.

APPENDIX 9B
CONSUMER PRICE INDEX ANALYSIS

In this report, the Consumer Price Indices for All Items, Private Transportation, New and Used Cars, and Gasoline were normalized to the base year 1975=100 in order to accommodate the price inflation that has occurred since the passage of AFER in the fall of 1975.

For this analysis, the new car price index was also adjusted to include the BLS* new model quality change price increases. However, BLS does not include quality change price rises when it calculates the new car price index.

The analysis assumed that all price increases between August and November in any one year were due to the price increase in the new models. The rise in the index between these two months was then inflated by the proportion of the price increase omitted by BLS. This additional increase in the price index was evenly distributed over the three months. The new car price index was then recalculated on a month by month basis. This yielded a new car price index with quality changes to the 1976 base for the years 1975 through 1978. These index numbers were then normalized to the revised 1975 average annual new car price index, which was 127.7 on the 1967 basis. The results of this analysis are contained in Tables 9B-1 through 9B-4.

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*BLS = Bureau of Labor Statistics; data from BLS Quality Change News Releases.

TABLE 9B-1. CONSUMER PRICE INDEX ANNUAL AVERAGE, BASE 1975 = 100

YEAR	ALL ITEMS 161.2=100	PRIVATE TRANSP. 149.8=100	USED CARS 146.4=100	GASOLINE 170.8=100	NEW CAR (INCLUDES Q) 127.7=100
1968	64.6	68.8	0	59.4	*
1969	68.1	71.1	70.4	61.3	*
1970	72.1	74.2	71.2	61.8	*
1971	75.2	77.8	75.3	62.2	*
1972	77.7	78.4	75.5	63.0	*
1973	82.6	81.1	80.3	69.1	*
1974	91.6	91.2	83.7	93.6	*
1975	100.0	100.0	100.0	100.0	100.0
1976	105.8	109.9	114.7	104.2	106.9
1977	112.6	117.9	124.9	110.2	113.4
1978	121.2	123.5	127.4	114.9	122.7

Q=Quality changes
*=Figures not available prior to 1975

Jan 31, 1979

Source: TSC Analysis of Bureau of Labor Statistics Data.

TABLE 9B-2. CONSUMER PRICE INDEX ALL ITEMS, PRIVATE TRANSPORTATION, USED CAR AND GASOLINE, BASE 1975 = 100

	ALL ITEMS CPI 161.2=100	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
1975	SERIES A	96.8	97.5	97.9	98.3	98.8	99.6	100.7	101.0	101.5	102.1	102.7	103.2	100.0
1976		103.4	103.7	103.9	104.3	105.0	105.5	106.1	106.6	107.1	107.5	107.8	108.1	105.8
1977		108.7	109.9	110.5	111.4	112.0	112.8	113.3	113.7	114.1	114.5	115.0	115.4	112.6
1978		116.1	116.9	117.7	118.8	119.9	121.2	122.0	122.7	123.6	124.6	125.3	125.9	121.2
	PRIVATE TRANSPORTATION 149.8=100													
1975	SERIES E-1	94.9	95.1	96.1	97.1	98.0	99.7	101.7	102.4	102.7	103.3	104.2	104.3	100.0
1976		104.7	104.9	105.8	106.9	108.5	110.1	111.3	112.0	112.6	113.6	113.9	114.0	109.9
1977		114.4	115.3	116.2	117.7	118.7	119.3	119.4	119.0	118.7	118.8	118.8	118.8	117.9
1978		119.0	119.2	119.6	120.4	121.9	123.5	124.7	125.3	125.7	126.4	127.6	128.5	123.5
	USED CARS 146.4=100													
1975	SERIES K-4	92.1	91.2	92.4	94.3	97.1	100.8	104.6	106.6	107.0	106.9	105.0	102.2	100.0
1976		98.8	99.0	103.1	108.9	114.6	118.4	121.2	122.7	123.0	122.9	122.3	121.6	114.7
1977		121.4	122.3	124.8	128.3	130.7	131.3	130.2	127.3	124.7	121.6	119.5	116.6	124.9
1978		116.0	116.1	117.7	121.1	126.1	130.8	133.8	134.4	133.8	133.5	133.0	132.5	127.4
	GASOLINE 170.8=100													
1975		93.8	94.0	94.3	95.3	97.0	99.9	104.2	104.8	105.1	104.6	103.8	103.4	100.0
1976		103.1	102.0	100.6	100.2	101.8	104.5	105.7	106.4	106.6	106.6	106.4	106.1	104.2
1977		106.1	107.4	108.3	109.5	110.8	111.6	111.8	111.7	111.5	111.2	111.1	111.3	110.2
1978		111.2	110.9	110.9	111.4	112.3	113.8	115.5	117.0	118.0	118.2	191.1	120.7	114.9

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TABLE 9B-3. CONSUMER PRICE INDEX, NEW CAR INDEX (Includes Quality Change "Q") Base 1975 = 100

	NEW CARS "Q" 1967=100	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
1975									126.8	126.6	130.2	131.7	134.4	129.9
1976		134.6	134.7	134.9	134.8	134.9	134.9	134.8	134.8	135.4	140.7	141.6	142.0	136.5
1977		142.8	142.4	142.6	142.3	143.1	143.4	143.3	143.3	143.0	148.0	150.9	153.2	144.9
1978		153.6	153.9	153.8	153.9	155.2	156.3	156.7	156.6	156.6	158.8	162.2	163.5	156.8
	NEW CARS "Q" 1975=127.7= 100													
1975		96.6	97.5	99.7	99.8	99.3	99.5	99.1	99.3	99.1	102.0	103.1	105.2	100.0
1976		105.4	105.5	105.6	105.6	105.6	105.6	105.6	105.6	106.0	110.2	110.9	111.2	106.9
1977		111.8	111.5	111.7	111.4	112.1	112.3	112.2	112.2	112.0	115.9	118.2	120.0	113.4
1978		120.3	120.5	120.4	120.5	121.5	122.4	122.7	122.6	122.6	124.4	127.0	128.0	122.7

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TABLE 9B-4. SEASONALLY ADJUSTED CONSUMER PRICE INDEX FOR USED CARS, BASE 1975 = 100

USED CARS 146.4=100	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
1975	96.1	97.2	97.4	97.1	96.9	98.3	100.5	102.3	102.8	103.5	103.6	103.5	100.0
1976	103.4	105.7	108.7	112.0	114.1	115.4	116.3	117.4	118.2	119.1	120.9	123.5	114.7
1977	126.7	130.9	132.8	133.3	131.6	128.7	125.2	122.2	119.2	116.7	116.7	117.1	124.9
1978	121.6	124.1	124.0	124.7	125.3	127.4	128.3	128.6	128.6	129.6	131.7	135.0	127.4

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